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Plume Vertical Velocity Assessment for the Air Cooled Condensers

Palmdale Energy Project

Palmdale, California

Submitted to California Energy Commission

Submitted by

Palmdale Energy, LLC

Prepared by **Atmospheric Dynamics, Inc.**



ATMOSPHERIC DYNAMICS, INC Meteorological & Air Quality Modeling

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Introduction

Palmdale Energy, LLC is proposing to develop the Palmdale Energy Project (PEP), located near the Palmdale Airport. The combined-cycle project will utilize two (2) Siemens SCC6-5000F natural gasfired combustion turbine generators (CTG) and two (2) heat recovery steam generators (HRSG) with supplemental duct firing and a 32 cell air cooled condenser (ACC). The PEP site will be located on an approximately 50-acre undeveloped parcel west of the northwest corner of U.S. Air Force Plant 42. Based on updated ACC stack parameter data, provided by Siemens, a revised analysis of the ACC plume characteristics on vertical winds was prepared and compared to the California Energy Commission (CEC) significance criteria for the average vertical plume velocities as described below.

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

In May, 2016 Palmdale Energy, LLC submitted the results of our ACC plume rise screening analysis. Recently an error in the ACC exit velocity data provided by our vendor was discovered and we are therefore submitting a revised analysis for CEC staff review.

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

The Spillane methodology is generally applied to a limited number of plume source geometry's (turbines, power plant boilers, etc.) with the stacks arranged linearly (in a single straight-line) and separated by distances that typically exceed the individual stack diameters. For this assessment, a conservative assumption was made in order to use the Spillane methodology on an atypical ACC plume configuration which is made up of 32 plumes or cells arranged on a two dimensional surface. Here, the methodology, as described below, assumed all operating ACC cells were merged into a single equivalent ACC cell with an effective diameter based on the combined diameters of all operating cells. In other words, a single large cell was assumed to initially describe the release parameters of the ACC.

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



Screening Methodology and Vertical Plume Velocity Calculations for ACC

The ACC is comprised of 32 individual cells, arranged along four rows of eight cells each in 4 x 8 matrix. Thus, the 32 cells or radiators are arranged along two axis of direction producing a two dimensional plane in both the x and y directions. ACC stack parameter data (plume velocity, plume temperature) was provided by Siemens and the ACC manufacturer. The ACC will utilize variable speed fans. Additionally, the number of fans that are operational are dependent upon ambient temperature and plant load. For all ambient conditions, plant operation was assumed to be at full load. Thus, during cold winter and annual average conditions, all 32 fans would be operational at lower fan speeds. During worst-case hot summer days, 30 fans would be operational at the maximum fan speed. This data is summarized in Table 1.

Table 1 ACC Stack Character	istics for Vertica	I Plume Velocity	/ Analysis
Case #	1	2	3
Ambient Temp (°F)*	23	64	98
Number of ACC Cells in Use*	32	32	30
Heat Rejection (MW)*	447.23	447.36	445.28
Exhaust Flow Rate (lb/hr)*	1.818E8	2.440E8	2.150E8
Cell Exit Temperature (°F)*	59.0	90.32	130.10
Cell Height (ft)*	130	130	130
Effective Cell Diameter (ft)	47.169	47.169	47.169
Effective Stack Diameter (ft)	266.83	266.83	258.36
Stack Exit Velocity (ft/s)*	13.16	18.60	18.67
*ACC stack data provided by Siemens	motor of 17 17 fact t	the equare of the	number of

** Calculated value based on the cell diameter of 47.17 feet to the square of the number o operating cells or for example, Case #1: $D_{eff} = 47.17^*\sqrt{32}$

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. The thirty to thirty-two radiator cells (depending upon operating case number) are arranged in the 4 x 8 pattern. Therefore, the Spillane methodology was used for a single source with the effective stack diameter for the number of operating cells in use for each ambient temperature. For the cold day Case #1 and annual average Case #2, the effective single plume diameter would be based on 32 cells, while for the summer Case #3, the effective diameter would be based on 30 cells. The effective diameter for the single cell for each of the three ambient temperatures are presented in Table 1. The plume velocities were then calculated using the Spillane methodology for a single effective diameter.

Results

Screening level vertical plume velocity assessments were made for the range of ambient temperatures with calm winds and neutral atmospheric conditions for the three cases presented in Table 1. The total heat rejection for the three ambient cases are similar to each other and are based on the plant at 100 percent load. The use of variable speed fans and the ability to cycle each fan based on the cooling needs of the plant will allow the ability to minimize plume exit temperature and velocity. The results based on the three ambient conditions are presented in Table 2 and the output from the calculation worksheet provided in Attachment A.



Because of the large effective stack diameters, the initial jet phase extends to a height of about 1,750 feet above grade level (ft-agl) for Case 3 to almost 1,800 ft-agl for Cases 1 and 2. Thus, the previously accepted critical height of 1,500 feet occurs in the jet phase, and the results in Table 2 were interpolated by height from the stack exit velocity to the height at the top of the jet (with a plume average velocity of one-half the exit velocity). After the jet phase, plume temperature buoyancy characteristics modeled in the Spillane methodology cause an increase in plume-average vertical velocities to a peak velocity at some distance above the jet, after which plume average vertical velocities again decrease. The heights of maximum plume vertical velocities occur around 2,800 ft-agl for all three cases as shown in Attachment A.

Table 2 ACC Vertical Plume Vel	locity Analysis R	esults for Refer	ence Height
Case #	1	2	3
Ambient Temp (°F)	23	64	98
Single Plume Results (m/s):			
at 1,500-feet agl (Within the Jet Phase)	2.36	3.34	3.28
Maximum Velocity above 1500- feet agl	4.72	4.71	4.87

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 through 1,500 feet-agl and above for the ACC. The heights at which plume-averaged vertical velocities exceed 5.3 m/s only occur during the jet phase for Cases 2 and 3 and occur at a height of 240 ft-agl as shown in Attachment A. For Case 1, the jet phase velocity is always less than 5.3 m/s. These cases also represent the worst-case conditions of calm winds at all levels of a neutral atmosphere.

These screening results indicate that mechanical and thermal turbulence levels due to the flow from the ACC always remain in the light turbulence category and below the significance level of 5.3 m/s at all heights above 1,500 ft-agl. Even light wind speeds can dramatically decrease the predicted plume-averaged vertical velocities so the above results are very conservative indications of adverse conditions. The important factor for a given location is the appropriateness of available information for estimating true wind and temperature profiles throughout a typical year. Theoretical calculations, as shown in the tables above, are likely to overestimate the expected vertical velocities, for the following reasons:

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



Attachment A Spillane Method Plume Velocity Calculations



SINGLE Plume Average Vertical Velocities fo								
	"Aviation Sat					ditions at 1	arious Heights in the Plume	
	" The Evaluat		-	-			-	
		from a Gas-	I urbine Pow		-		Australia," Dr. K.T. Spilla	
Ambient Conditions:	000.45	Kabiaa	23.0		Constants:		eutral conditions (dθ/dz=0 or meters/feet	θ _a =θ _e)
Ambient Potential Temp θ _a	208.15	Kelvins	23.0	-1-	Oit			
Plume Exit Conditions:					Gravity g		m/s ²	
Stack Height hs		meters	130.0		λ	1.11		
Stack Diameter D	81.3297		266.83		λο	~1.0		
Stack Velocity Vexit	4.01			ft/sec				
Volumetric Flow	20,832.08		44,140,674		πV _{exit} D ² /4			Sect.2/¶1
Stack Potential Temp θ _s		Kelvins	59.00	°F	2			
Initial Stack Buoyancy Flux Fo	4,515.06						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	$, \theta_p$ at plume height (see below	N)
Conditions at End (Top) of Jet Phase:								
Height above Stack zjet	508.311		1667.7		$z_{jet} = 6.25D$), meters*=	meters above stack top	Sect.3/¶1
Height above Ground z _{jet} +hs	547.931		1797.7					
Vertical Velocity V _{jet}	2.005			ft/sec	$V_{jet} = 0.5V$	$e_{xit} = V_{exit}/2$		
Plume Top-Hat Diameter 2a _{jet}	162.659	meters	533.7	feet	$2a_{jet} = 2D$		Conservation of momentum	
pillane Methodology - Analytical Solutions	or Calm Con	ditions for PI	ume Heights	above Jet	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		olutions in T					crease with height	Sect.2/Eq.6
Virtual Source Height z _v	17.958	meters*	58.9	feet*	6.25D[1-(θ _e	/θ _s) ^{1/2}], met	ers*=meters above stack top	Sect.2/Eq.6
Height above Ground zv+hs	57.578	meters	188.9	feet			where $(\theta_a/\theta_s)^{1/2} = (\theta_e/\theta_s)^{1/2} =$	0.9647
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	157.305	m²/s			V _{exit} D/2(θ _e /			
Solve for plume-averaged vertical velo	city at height	1,500.0	feet	457.2	meters abo	we ground (z'+h _s)	
Gives the following Height above Stack z'	417.580	meters*	1370.0	feet*		Height E	ntered < Top of Jet - Canno	ot Be Solv
Plume Top-Hat Diameter 2a'	#N/A	meters	#N/A	feet	2a'=2*0.16	(z'-z _v)		Sect.2/Eq.6
Vertical Velocity V	#N/A	m/s	#N/A	ft/sec	V={(Va) ₀ 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}		meters	#N/A				ultaneously in both eqs. (i.e.,	
Height above Ground z _{crit} +h _s		meters	#N/A				e cubic equation ax ³ +bx ² +cx	
					101 1 = 1.0 1		and b=-(0.12F _o)/(4.3 ³ 0.16 ³)=	-888.49
Interpolated Height of critical vertical ve	elocity in Jet	Phase:			and o		.25D-z _v) ² -(Va) _o ³]/(4.3 ³ 0.16 ³)=	2072527
			,		cirici c	-[0.1210(0		
Find Height above Stack z	#N/A	meters	#N/A	feet				
Find Height above Stack z _{crit}		meters	#N/A #N/A			aive	$\frac{\text{http://www.1728.}}{\text{http://www.1728.}}$	
Find Height above Stack z _{crit} Height above Ground z _{crit} +h _s		meters meters	#N/A #N/A			give	s the real solution x = z-zv =	-400.91
Height above Ground z _{crit} +h _s	#N/A	meters	#N/A	feet	d of iot ph		es the real solution x = z-zv = or z(m) =	-400.91 -382.9
Height above Ground z _{crit} +h _s	#N/A Plume-averag	meters ed Vertical V	#N/A	feet Inting at en	d of jet pha		s the real solution x = z-zv =	-400.91
Height above Ground z _{cm} +h _s Fable of Plume Top-Hat Diameters (2a) and P Height (feet)	#N/A Plume-averag (meters)	meters ed Vertical V Plume	#N/A /elocities sta Vert.	feet Inting at en Plume	d of jet pha		es the real solution x = z-zv = or z(m) =	-400.91 -382.9
Height above Ground z _{ern} +h _s Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground	#N/A Plume-averag (meters) above stack	meters ed Vertical V Plume Radius(m)	#N/A /elocities sta Vert. Vel(m/s)	feet Inting at en		ase:	es the real solution x = z-zv = or z(m) = z(ft) =	-400.91 -382.9
Height above Ground z _{em} +h _s Table of Plume Top-Hat Diameters (2a) and F Height (feet) above ground <u>Stack.Rel.Ht = 130.0</u>	#N/A Plume-averag (meters) above stack <u>0.00</u>	meters ed Vertical V Plume Radius(m) 40.665	#N/A /elocities sta Vert. Vel(m/s) 4.01	feet Inting at en Plume			es the real solution x = z-zv = or z(m) = z(ft) =	-400.91 -382.9
Height above Ground z _{crit} +h _s Table of Plume Top-Hat Diameters (2a) and F Height (feat) above ground <u>Stack. Rel.Ht = 130.0</u> 150.0	#N/A Plume-averag (meters) above stack <i>0.00</i> 6.10	meters ed Vertical V Plume Radius(m) 40.665 41.153	#N/A /elocities sta Vert. Vel(m/s) 4.01 3.99	feet Inting at en Plume	Jet Phase	ase: /Interpolat	is the real solution $x = z \cdot zv =$ or $z(m) =$ z(ft) = ed	-400.91 -382.9
Height above Ground z _{crit} +h _s Table of Plume Top-Hat Diameters (2a) and F Height (feat) above ground <u>Stack.Rel.Ht = 130.0</u> 150.0 200.0	#N/A Plume-averag (meters) above stack 0.00 6.10 21.34	meters ed Vertical V Plume Radius(m) 40.665 41.153 42.372	#N/A /elocities sta Vert. Vel(m/s) <u>4.01</u> 3.99 3.93	feet Inting at en Plume	Jet Phase	ase: /Interpolat	es the real solution x = z-zv = or z(m) = z(ft) =	-400.91 -382.9
Height above Ground z _{critt} +h _s Fable of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 130.0 150.0 200.0 300.0	#N/A Plume-averag (meters) above stack 0.00 6.10 21.34 51.82	meters ed Vertical N Plume Radius(m) 40.665 41.153 42.372 44.810	#N/A /elocities sta Vert. Vel(m/s) 4.01 3.99 3.93 3.81	feet Inting at en Plume	Jet Phase	ase: /Interpolat	is the real solution $x = z \cdot zv =$ or $z(m) =$ z(ft) = ed	-400.91 -382.9
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Height above Ground z _{cm} +h _s Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 130.0 150.0 200.0 300.0 400.0 500.0 500.0	#N/A Plume-averag (meters) above stack 0.00 6.10 21.34 51.82 82.30 112.78 143.26	meters ed Vertical V Plume Radius(m) 40.665 41.153 42.372 44.810 47.248 49.687 52.125	#N/A Velocities sta Vert. Vel(m/s) 4.01 3.99 3.93 3.81 3.69 3.57 3.44	feet Inting at en Plume	Jet Phase	ase: /Interpolat	is the real solution $x = z \cdot zv =$ or $z(m) =$ z(ft) = ed	-400.91 -382.9
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Height above Ground z _{cm} +h _s Fable of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 130.0 1500.0 200.0 3000.0 400.0 5000.0 600.0 7000.0 8000.0 1000.0 1100.0 1100.0	#N/A "lume-averagg (meters) above stack 0.00 6.10 21.34 51.82 82.30 112.78 143.26 173.74 204.22 234.70 265.18 295.66	meters ed Vertical N Plume Radius(m) 40.665 41.153 42.372 44.810 47.248 49.667 52.125 54.564 57.002 59.440 61.879 64.317	#N/A /elocities sta Vel(m/s) 3.99 3.33 3.81 3.69 3.57 3.44 3.32 3.20 3.20 3.08 2.266 2.84	feet Inting at en Plume	Jet Phase	ase: /Interpolat	is the real solution $x = z \cdot zv =$ or $z(m) =$ z(ft) = ed	-400.91 -382.9
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Height above Ground z _{cm} +h _s Fable of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 130.0 1500.0 200.0 3000.0 400.0 5000.0 600.0 7000.0 8000.0 1000.0 1100.0 1100.0	#N/A "lume-averagg (meters) above stack 0.00 6.10 21.34 51.82 82.30 112.78 143.26 173.74 204.22 234.70 265.18 295.66	meters ed Vertical N Plume Radius(m) 40.665 41.153 42.372 42.372 43.87 42.372 43.87 52.125 53.564 54.564 57.002 59.440 61.879 64.317 66.756	#N/A /elocities sta Vel(m/s) 3.99 3.33 3.81 3.69 3.57 3.44 3.32 3.20 3.20 3.08 2.266 2.84	feet Inting at en Plume	Jet Phase	ase: /Interpolat	is the real solution $x = z \cdot zv =$ or $z(m) =$ z(ft) = ed	-400.91 -382.9
Height above Ground z _{cm} +h _s Fable of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 130.0 150.0 2000.0 300.0 400.0 500.0 6000.0 700.0 800.0 1000.0 1100.0 1100.0	#N/A "lume-average (meters) above stack 0.00 6.10 21.34 51.82 82.30 112.78 143.26 113.74 204.22 234.70 265.18 295.66 326.14	meters ed Vertical N Plume Radius(m) 40.665 41.153 42.372 44.810 47.248 49.687 52.125 54.564 57.002 59.440 61.879 64.317 66.756 69.194 71.632	#NVA /elocities stat Vert. Vel(m/s) 3.99 3.381 3.69 3.57 3.44 3.32 3.02 3.08 2.96 2.84 2.72 2.60 2.48	feet rrting at en Plume Temp(K)	Jet Phase	ase: /Interpolat	is the real solution $x = z \cdot zv =$ or $z(m) =$ z(ft) = ed	-400.91 -382.9
Height above Ground z _{ent} +h _s Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 130.0 150.0 200.0	#NVA "lume-averag (meters) above stack 0.00 6.10 21.34 51.82 82.30 112.78 143.26 173.74 204.22 234.70 265.18 295.66 326.614 356.62	meters ed Vertical N Plume Radius(m) 40.665 41.153 42.372 44.810 47.248 49.687 52.125 54.564 57.002 59.440 61.879 64.317 66.756 69.194 71.632	#NVA /elocities stat Vert. Vel(m/s) 3.99 3.381 3.69 3.37 3.44 3.32 3.20 3.00 2.96 2.84 2.27 2.260	feet rrting at en Plume Temp(K)	Jet Phase	ase: /Interpolat	is the real solution $x = z \cdot zv =$ or $z(m) =$ z(ft) = ed	-400.91 -382.9
Height above Ground z _{cm} +h _s Fable of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack. Rel.Ht = 130.0 1500.0 300.0 300.0 300.0 300.0 300.0 300.0 300.0 300.0 300.0 1000.0 1000.0 1100.0 11200.0 1300.0 11200.0	#N/A Plume-averagg (meters) above stack 0.00 21.34 51.82 82.30 112.78 1143.26 1173.74 204.22 234.70 265.18 295.66 326.14 356.62 387.10	meters ed Vertical N Plume Radius(m) 40.665 41.153 44.317 52.125 54.564 57.002 59.440 61.879 64.317 66.756 69.194 71.632 74.071	#NVA /elocities stat Vert. Vel(m/s) 3.99 3.381 3.69 3.57 3.44 3.32 3.02 3.08 2.96 2.84 2.72 2.60 2.48	feet rrting at en Plume Temp(K)	Jet Phase	ase: /Interpolat	is the real solution $x = z \cdot zv =$ or $z(m) =$ z(ft) = ed	-400.91 -382.9
Height above Ground z _{cm} +h _s Fable of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 130.0 1500.0 200.0 3000.0 4000.0 5000.0 3000.0 4000.0 5000.0 1000.0 1000.0 1	#NVA Plume-average (meters) above stack 0.00 6.10 21.34 51.82 82.30 112.78 143.26 173.74 204.22 234.70 265.18 295.66 326.14 356.62 387.10 417.58	meters ed Vertical N Plume Radius(m) 40.665 41.153 42.372 44.810 47.248 49.687 52.125 54.564 54.564 54.564 54.564 57.002 59.440 61.879 64.317 66.756 69.194 71.632 74.071 76.509	#NVA /elocities stat Vert. Vel(m/s) 3.99 3.33 3.81 3.69 3.57 3.44 3.32 3.20 3.08 2.96 2.84 2.72 2.60 2.484 2.36	feet rting at en Plume Temp(K)	Jet Phase	ase: /Interpolat	is the real solution $x = z \cdot zv =$ or $z(m) =$ z(ft) = ed	-400.91 -382.9
Height above Ground z _{entr} +h _s Fable of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 130.0 1500.0 1500.0 1500.0 1500.0 1500.0 1000.0 1000.0 1000.0 1100.0 10	#N/A "lume-averag (meters) above stack 0.00 6.10 21.34 51.82 82.30 112.78 143.26 113.74 204.22 234.70 265.18 225.66 326.14 356.62 387.10 417.58 448.06	meters ed Vertical N Plume Radius(m) 40.665 41.153 42.372 44.810 47.248 49.687 52.125 54.564 57.002 59.440 61.879 64.317 66.756 69.194 71.632 74.071 76.509 78.947	#NVA /elocities stat Vert. Vel(m/s) 3.99 3.381 3.69 3.57 3.44 3.32 3.20 3.08 2.96 2.248 2.272 2.60 2.48 2.248 2.248 2.248	feet rting at en Plume Temp(K)	Jet Phase	ase: /Interpolat	is the real solution $x = z \cdot zv =$ or $z(m) =$ z(ft) = ed	-400.91 -382.9
Height above Ground z _{cm} +h _s Fable of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 130.0 1500.0 200.	#N/A "Iume-average (meters) above stack 0.00 6.10 21.34 51.82 82.30 112.78 143.26 173.74 204.22 234.70 265.18 295.66 2326.14 326.62 387.10 417.58 448.06 478.54	meters ed Vertical N Plume Radius(m) 40.665 41.153 42.372 44.810 47.248 49.687 52.125 54.564 57.002 59.440 61.879 64.317 66.756 69.194 71.632 74.071 76.509 78.947	#N/A /elocities stat Vert. Vel(m/s) 3.99 3.381 3.69 3.377 3.44 3.32 3.80 2.96 2.44 2.72 2.66 2.44 2.36 2.24 2.36	feet rting at en Plume Temp(K)	Jet Phase	ase : /Interpolat < 5.3m/s e	is the real solution $x = z \cdot zv =$ or $z(m) =$ z(ft) = ed	-400.91 -382.9
Height above Ground z _{cm} +h _s Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 130.0 500.0 300.0 400.0 600.0 600.0 600.0 600.0 1000.0 1000.0 1000.0 11000.0 11000.0 11000.0 11000.0 1500.0 1500.0 1500.0 1500.0 1500.0 1500.0 1500.0 1500.0 1500.0 1500.0 1500.0 1500.0 1500.0 1500.0 1500.0	#NVA Plume-averag (meters) above stack 0.00 21.34 51.82 82.30 112.78 1143.26 1	meters ed Vertical N Plume Radius(m) 40.665 41.153 44.317 52.125 54.564 57.002 59.440 61.879 64.317 66.756 69.194 71.632 74.071 76.509 78.947 80.037 81.330	#NVA Velcocities stat Vert. Vel(m/s) 3.99 3.33 3.81 3.69 3.57 3.44 3.32 3.00 2.96 2.84 2.72 2.600 2.48 2.36 2.24 2.24 2.24 2.24 2.24	feet rting at en Plume Temp(K)	Jet Phase Jet Phase Spillane E	ase : /Interpolat < 5.3m/s e	is the real solution $x = z \cdot zv =$ or $z(m) =$ z(ft) = ed	-400.91 -382.9
Height above Ground z _{ent} +h _s Fable of Plume Top-Hat Diameters (2a) and P Height (feet) above ground <i>Stack.Rel.Ht =</i> 130.0 1500.0 2000.0 2	#NVA Plume-average (meters) above stack 0.00 6.10 21.34 51.82 82.30 112.78 143.26 173.74 204.22 234.70 265.18 295.66 326.14 356.62 387.10 417.58 448.06 478.54 492.16 508.32	meters ed Vertical N Plume Radius(m) 40.665 41.153 44.810 47.248 49.687 52.125 54.564 54.564 54.564 54.564 54.564 54.564 57.002 59.440 61.879 66.756 69.194 71.632 74.071 76.509 78.947 80.037 81.330 78.570	#NVA /relocities stat Vert. Vel(m/s) 3.99 3.33 3.81 3.69 3.57 3.44 3.32 3.20 3.08 2.84 2.72 2.60 2.84 2.36 2.24 2.12 2.07	feet rring at en Plume Temp(K)	Jet Phase Jet Phase Spillane E	ase : /Interpolat < 5.3m/s e 2.3m/s e 3.0.12F ₀ ((z-z	is the real solution x = z-zv = or z(m) = z(t) = ed verywhere	-400.91 -382.9
Height above Ground z _{cm} +h _s Table of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack. Rel.Ht = 130.0 150.0 200.0	#NVA #Iume-average (meters) above stack 0.00 6.10 21.34 51.82 82.30 112.78 143.26 173.74 204.22 234.70 265.18 295.66 326.614 326.64 326.75	meters ed Vertical N Plume Radius(m) 40.665 41.153 44.317 52.125 54.544 96.87 52.125 54.564 57.002 59.440 61.879 64.317 66.756 69.194 71.632 74.071 76.509 78.947 80.037 81.330 81.330	#N/A /elocities stat Vert. Vel(m/s) 3.99 3.31 3.69 3.357 3.44 3.322 3.20 3.86 2.96 2.44 2.22 2.06 2.44 2.24 2.12 2.07 2.01 2.06 3.31	feet rting at en Plume Temp(K) 276.01 272.50	Jet Phase Jet Phase Spillane E V _{plum=} (Va), a = 0.16(z-	ase: /interpolat < 5.3m/s e 	is the real solution x = 2-zv = or z(m) = z(ft) = ed verywhere y ² -(6.25D-z,y ²)) ^{1/2} / a	-400.91 -382.9
Height above Ground z _{ent} +h _s Fable of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 130.0 1500.0 200	#NVA Plume-averagy (meters) above stack 0.00 1.134 51.82 82.30 112.78 143.26	meters ed Vertical 1 Plume Radius(m) 40.665 41.153 42.372 44.810 47.248 49.687 52.125 54.564 57.002 59.440 64.317 66.756 69.194 71.632 74.071 76.509 78.947 80.037 81.330 78.570 83.447 88.324	#NVA Velocities stat Vert. Vel(m/s) 3.99 3.81 3.69 3.57 3.444 3.320 3.08 2.366 2.84 2.36 2.44 2.26 2.48 2.36 2.44 2.24 2.07 2.07 2.06 3.31 3.83	feet rting at en Plume Temp(K) 276.01 272.50 271.50	Jet Phase Jet Phase Spillane E V _{plum=} (Va), a = 0.16(z-	ase: /interpolat < 5.3m/s e 	is the real solution x = z-zv = or z(m) = z(t) = ed verywhere	-400.91 -382.9
Height above Ground z _{ent} +h _s above Ground z _{ent} +h _s above ground Stack.Rel.Ht = 130.0 150.0 100.0 100.0 1100	#NVA #Iume-average (meters) above stack 0.00 6.10 21.34 51.82 82.30 112.78 143.26 173.74 204.22 234.70 265.18 295.66 326.14 356.62 387.10 417.58 448.06 478.54 492.16 508.32 509.02 539.50 569.98 600.46	meters ed Vertical 1 Plume Radius(m) 40.665 41.153 44.317 52.125 54.564 57.002 59.440 61.879 64.317 66.756 69.194 71.632 74.071 76.509 78.947 80.037 81.330 78.570 83.3447 88.324	#NVA /relocities stat Vert. Vel(m/s) 3.99 3.81 3.69 3.57 3.44 3.32 3.20 3.08 2.84 2.72 2.60 2.48 2.36 2.24 2.12 2.07 2.00 3.31 3.83 4.14	feet rting at en Plume Temp(K) 276.01 272.50 271.50 270.94	Jet Phase Jet Phase Spillane E V _{plum=} (Va), a = 0.16(z-	ase: /interpolat < 5.3m/s e 	is the real solution x = 2-zv = or z(m) = z(ft) = ed verywhere y ² -(6.25D-z,y ²)) ^{1/2} / a	-400.91 -382.9
Height above Ground z _{em} +h _s able of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 130.0 Stack.Rel.Ht = 130.0 (150.0 (#N/A */ume-averag (meters) above stack 6.00 6.10 21.34 51.82 82.30 112.78 143.26 1143.26 1143.26 1143.26 1143.26 1143.26 125.18 225.66 326.14 356.62 387.10 417.58 448.06 478.54 492.16 509.02 539.50 569.98 600.46 630.94	meters ed Vertical N Plume Radius(m) 40.665 41.153 44.810 42.372 44.810 47.248 49.687 52.125 54.564 54.564 54.564 57.002 59.440 61.879 66.756 69.194 71.632 74.071 76.509 78.947 78.947 81.330 78.570 83.447 83.244 93.200 98.077	#NVA /elocities stat Vert. Vel(m/s) 3.99 3.331 3.69 3.57 3.44 3.320 3.08 2.96 2.48 2.24 2.260 2.48 2.36 2.24 3.331 3.83 3.83 3.83 3.83 3.83 3.83 3.81 3.83 3.81 3.83 3.83 3.84 3.81 3.81 3.82 3.83 3.83 3.83 3.83 3.83 3.83 3.83 3.83 3.83 3.83 3.83 3.83 3.83 3.83 4.14	feet Plume Temp(K) 276.01 272.50 271.50 270.94 270.55	Jet Phase Jet Phase Spillane E V _{plum=} (Va), a = 0.16(z-	ase: /interpolat < 5.3m/s e 	is the real solution x = 2-zv = or z(m) = z(ft) = ed verywhere	-400.91 -382.9
Height above Ground z _{ent} +h ₅ Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 130.0 150.0 200.0	#NVA Plume-averagy (meters) above stack 0.00 21.34 51.82 82.30 112.78 143.26 173.74 204.22 234.70 265.18 295.66 387.10 417.58 428.64 387.10 417.58 428.64 439.26 509.02 539.50 569.98 600.46 630.44 691.90	meters ed Vertical 1 Plume Radius(m) 40.665 41.153 42.372 44.810 47.248 49.687 52.125 54.564 57.002 59.440 61.879 64.317 66.756 69.194 71.632 74.071 76.509 78.947 80.037 81.320 78.570 83.2447 88.324 93.200 98.077 107.831	#NVA Velocities stat Vert. Vel(m/s) 3.99 3.81 3.69 3.57 3.44 3.32 3.20 3.00 2.96 2.84 2.36 2.48 2.36 2.48 2.36 2.48 2.36 2.48 2.36 2.48 3.31 3.33 4.14 4.33 4.57	feet rting at en Plume Temp(K) 276.01 272.50 271.50 270.94 270.55 270.03	Jet Phase Jet Phase Spillane E V _{plum=} (Va), a = 0.16(z-	ase: /interpolat < 5.3m/s e 	is the real solution x = 2-zv = or z(m) = z(ft) = ed verywhere	-400.91 -382.9
Height above Ground z _{ent} +h _s Fable of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack. Rel.Ht = 130.0 1500 2000 3000.0 4000.0 5000.0 6000.0 7000.0 3000.0 11000.0 12000.0 13000.0 14000.0 14000.0 1500.0 11000.0 11000.0 11000.0 11000.0 11000.0 11000.0 11000.0 11000.0 11000.0 11000.0 11000.0 11000.0 11000.0 11000.0 11000.0 11000.0 11000.0 11000.0 12000.0 12000.0 12000.0 12000.0 12000.0 12000.0 12000.0 12000.0	#NVA Plume-average (meters) above stack 0.00 1.134 51.82 82.30 112.78 143.26	meters ed Vertical N Plume Radius(m) 40.665 41.153 42.372 54.54 54.54 54.54 55.55 54.564 57.002 59.440 61.879 64.317 66.756 69.194 74.071 76.509 78.947 80.037 78.570 83.3447 88.324 93.200 98.077 107.831 117.584	#NVA Velocities stat Vert. Vel(m/s) 3.99 3.33 3.81 3.69 3.57 3.44 3.32 3.08 2.66 2.84 2.72 2.60 2.44 2.33 3.44 4.212 2.07 2.06 3.31 3.83 4.14 4.34 4.57 4.68	feet rting at en Plume Temp(K) 276.01 272.50 271.50 270.94 270.05 270.05 270.05 270.05 270.05	Jet Phase Jet Phase Spillane E $V_{plume}=((Va)_c$ $\theta_p=\theta_n(1+(1$	Squations: - 5.3m/s e - 5.3m/s e 	is the real solution x = 2-zv = or z(m) = z(ft) = ed verywhere	-400.91 -382.9
Height above Ground z _{ent} +h _s able of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 130.0 150.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	#N/A 'lume-averagi (meters) above stack 0.00 6.10 21.34 51.82 82.30 112.78 143.26 173.74 204.22 234.70 265.18 295.66 326.14 355.62 387.10 417.58 448.06 478.54 509.02 539.50 569.98 600.46 630.49 691.90 752.86 813.82	meters ed Vertical V Plume Radius(m) 40.665 41.153 44.810 42.372 54.4810 47.248 49.687 55.255 54.564 55.4564 57.002 59.440 61.879 64.317 66.756 69.194 71.632 74.071 76.509 78.947 80.037 81.330 78.570 83.3447 88.324 93.200 98.077 107.831 117.584	#NVA Velocities stat Vert. Vel(m/s) 3.99 3.81 3.69 3.57 3.44 3.22 3.20 3.08 2.84 2.72 2.60 2.484 2.36 2.24 2.12 2.07 2.001 3.33 4.14 4.57 4.66 4.72	feet rting at en Plume Temp(K) 276.01 272.50 270.94 270.55 270.03 269.70 269.46	Jet Phase Jet Phase Spillane E V _{plum=} (Va), a = 0.16(z-	Squations: - 5.3m/s e - 5.3m/s e 	is the real solution x = 2-zv = or z(m) = z(ft) = ed verywhere	-400.9 -382.9
Height above Ground z _{ent} +h _s Table of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack.Rel.Ht = 130.0 (1900) 3000.0 (1900) 3000.0 (1900) 3000.0 (1900) 3000.0 (1900) 3000.0 (1900) 3000.0 (1900) 3000.0 (1900) 3000.0 (1900) 3000.0 (190	#NVA #Iume-average (meters) above stack 0.00 6.101 21.34 51.82 82.30 112.78 143.26 173.74 204.22 204.70 265.18 295.66 205.61 326.61 326.62 387.10 417.58 429.26 509.02 539.50 569.98 600.44 630.94 631.92 874.78	meters ed Vertical 1 Plume Radius(m) 40.665 41.153 42.372 44.810 47.248 49.687 52.125 54.564 57.002 59.440 61.879 64.317 66.756 9194 71.632 74.071 76.509 78.947 80.037 81.330 78.570 83.447 88.324 93.200 98.077 107.831 117.584 137.092	#N/A Velocities stat Vert. Vel(m/s) 3.93 3.81 3.69 3.757 3.44 3.22 3.20 3.86 2.96 2.44 2.22 2.07 2.01 2.06 3.31 3.83 3.83 3.83 3.83 3.83 3.83 3.83 4.14 4.34 4.57 4.68 4.72 4.72	feet rting at en Plume Temp(K) 276.01 272.50 271.50 270.95 270.03 269.70 269.46 269.28	Jet Phase Jet Phase Spillane E $V_{plume}=((Va)_c$ $\theta_p=\theta_n(1+(1$	Squations: - 5.3m/s e - 5.3m/s e 	is the real solution x = 2-zv = or z(m) = z(ft) = ed verywhere	-400.9 -382.9
Height above Ground z _{ent} +h _s Fable of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 130.0 1500.0 200	#NVA Plume-averagy (meters) above stack 0.00 21.34 51.82 82.30 112.78 143.26 173.74 204.22 234.70 265.18 295.66 387.10 417.58 488.06 478.54 492.16 508.32 509.02 539.50 569.98 600.46 630.94 651.92 539.55 559.55 559.58 863.04 630.46 630.46 630.46 631.42 637.26	meters ed Vertical 1 Plume Radius(m) 40.665 41.153 42.372 44.810 47.248 49.687 52.125 54.564 55.042 55.4564 57.002 59.440 61.879 64.317 66.756 69.194 71.632 74.071 76.509 78.947 80.037 81.330 78.570 83.2447 88.324 93.200 98.077 107.831 117.584 127.338 137.032 146.845	#N/A /elocities stat Vert. Vel(m/s) 3.99 3.81 3.69 3.577 3.44 3.322 3.20 3.000 2.96 2.44 2.22 2.600 2.48 2.22 2.007 2.017 2.013 3.383 4.14 4.33 4.57 4.68 4.72 4.72 4.72 4.72 4.72	feet rting at en Plume Temp(K) 276.01 272.50 271.50 271.50 270.94 270.55 270.03 269.70 269.46 269.28 269.14	Jet Phase Jet Phase Spillane E $V_{plume}=((Va)_c$ $\theta_p=\theta_n(1+(1$	Squations: - 5.3m/s e - 5.3m/s e 	is the real solution x = 2-zv = or z(m) = z(ft) = ed verywhere	-400.9 -382.9
Height above Ground z _{ent} +h _s Fable of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack. Rel.Ht = 130.0 Stack. Rel.Ht = 130.0 1500.0 200.0 3000.0 4000.0 5000.0 3000.0 3000.0 4000.0 5000.0 3000.0 3000.0 3000.0 3000.0 3000.0 3000.0 3000.0 3000.0 3000.0 3000.0 3000.0 3000.0 3000.0 3000.0 3000.0 3000.0 1100.0 1100.0 1100.0 1100.0 1100.0 1100.0 1100.0 1100.0 1100.0 1100.0 1100.0 1100.0 1100.0 1200.0 <	#NVA #Iume-average (meters) above stack 0.00 6.10 21.34 51.82 82.30 112.78 143.26 1	meters ed Vertical N Plume Radius(m) 40.665 41.153 42.372 54.564 55.55 54.564 57.002 59.440 61.879 64.317 66.756 69.194 71.652 74.071 76.509 78.947 80.037 81.330 78.570 83.447 88.324 93.200 98.077 107.831 117.584 1	#NVA Velocities stat Vert. Vel(m/s) 3.99 3.33 3.81 3.69 3.57 3.444 3.32 3.08 2.66 2.84 2.72 2.60 2.84 2.33 3.81 3.83 2.44 2.260 2.84 2.107 2.007 2.011 3.83 4.14 4.57 4.68 4.72 4.71 4.68	feet rting at en Plume Temp(K) 276.01 272.50 271.50 270.94 270.93 269.70 269.28 269.28 269.24 269.29	Jet Phase Jet Phase Spillane E $V_{plume}=((Va)_c$ $\theta_p=\theta_n(1+(1$	Squations: - 5.3m/s e - 5.3m/s e 	is the real solution x = 2-zv = or z(m) = z(ft) = ed verywhere	-400.9 -382.9
Height above Ground z _{ent} +h _s Table of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack. Rel. Ht = 130.0 1500 2000 3000.0 3000.0 4000.0 5000.0 3000.0 3000.0 3000.0 4000.0 5000.0 3000.0 4000.0 5000.0 3000.0 4000.0 5000.0 3000.0 3000.0 3000.0 3000.0 3000.0 3000.0 11000.0 11000.0 11000.0 11000.0 11000.0 11000.0 11000.0 11000.0 11000.0 11000.0 11000.0 11000.0 11000.0 11000.0 11000.0 11000.0 12000.0 <	#N/A 'lume-averagi (meters) above stack 0.00 6.10 21.34 51.82 82.30 112.78 143.26 173.74 204.22 234.70 265.18 295.66 326.14 556.62 387.10 417.58 448.06 478.54 509.02 539.50 569.98 600.46 630.47 639.57 996.70 1057.66	meters ed Vertical 1 Plume Radius(m) 40.665 41.153 44.317 52.125 54.564 57.002 59.440 61.879 64.317 66.756 69.194 71.632 74.071 76.509 78.947 80.037 81.330 78.570 83.3447 88.324 93.200 98.077 107.831 117.584 127.338 137.092 146.845	#NVA /relocities stat Vert. Vel(m/s) 3.99 3.81 3.69 3.57 3.44 3.32 3.08 2.84 2.72 2.60 2.84 2.36 2.24 2.12 2.07 2.06 3.31 3.83 4.14 4.57 4.68 4.64	feet rting at en Plume Temp(K) 276.01 272.50 271.50 271.50 270.94 270.55 270.03 269.70 269.46 269.28 269.914 269.22 268.93	Jet Phase Jet Phase Spillane E $V_{plume}=((Va)_c$ $\theta_p=\theta_n(1+(1$	Squations: - 5.3m/s e - 5.3m/s e 	is the real solution x = 2-zv = or z(m) = z(ft) = ed verywhere	-400.91 -382.9
Height above Ground z _{ent} +h _s Table of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack. Rel.Ht = 130.0 150.0 200.0	#NVA #Iume-average (meters) above stack 0.00 6.10 21.34 51.82 82.30 112.78 143.26 173.74 204.22 234.70 265.18 295.66 325.614 326.54 326.614 326.63 387.10 417.58 428.63 387.10 417.58 60.046 630.94 630.94 639.98 600.46 630.94 639.574 935.74 935.74 935.74 996.70 1105.766 1118.62	meters ed Vertical 1 Plume Radius(m) 40.665 41.153 44.317 44.810 47.248 49.687 52.125 54.544 57.002 59.440 61.879 64.317 66.756 69.194 71.632 74.071 76.509 78.947 80.037 81.320 78.570 83.447 88.324 93.200 98.077 107.831 117.544 137.092 146.845 137.092 146.845 156.599 166.352 176.106	#N/A /elocities stat Vert. Vel(m/s) 3.99 3.81 3.69 3.377 3.44 3.322 3.20 3.86 2.96 2.44 2.22 2.00 2.44 2.242 2.12 2.07 2.01 2.001 3.331 3.333 4.14 4.57 4.68 4.72 4.71 4.68 4.64 4.60	feet rting at en Plume Temp(K) 276.01 272.50 271.50 270.94 270.05 270.03 269.46 269.28 269.14 269.02 268.93 268.85	Jet Phase Jet Phase Spillane E $V_{plume}=((Va)_c$ $\theta_p=\theta_n(1+(1$	Squations: - 5.3m/s e - 5.3m/s e 	is the real solution x = 2-zv = or z(m) = z(ft) = ed verywhere	-400.91 -382.9
Height above Ground z _{ent} +h _s Fable of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack. Rel.Ht = 130.0 1500.0 3000.0 4000.0 5000.0 3000.0 4000.0 5000.0 3000.0 4000.0 5000.0 600.0 7000.0 600.0 700.0 1000.0 1000.0 1100.0 1200.0 1400.0 1500.0 1400.0 1500.0 1400.0 1500.0 1600.0 1700.0 1744.7 70p of jet = 1797.7 1800.0 2000.0 21000.0 22000.0 22000.0 22000.0 22000.0 22000.0 28000.0 32000.0 32000.0 32000.0	#N/A "Iume-average (meters) above stack 0.00 11.32 21.34 51.82 82.30 112.78 113.26 113.26 113.74 204.22 234.70 265.18 225.66 326.14 326.26.14 326.26.14 326.26.14 326.26.14 326.26.14 326.26.14 326.26.14 326.14 326.14 326.14 327.10 447.854 492.16 509.02 509.02 509.03 509.04 60.04 630.94 630.94 630.94 630.94 630.94 630.94 630.94 935.74 9935.74 9935.74 9935.74 9935.74<	meters e e e e e e e e e e e e e e e e e e	#NVA Velocities stat Vert. Vel(m/s) 3.99 3.33 3.81 3.69 3.57 3.44 3.32 3.20 3.08 2.96 2.84 2.36 2.48 2.36 2.48 2.24 2.00 2.48 2.12 2.007 2.01 3.31 3.83 4.14 4.55 4.68 4.72 4.71 4.68 4.64 4.64 4.60 4.55	feet rting at en Plume Temp(K) 276.01 272.50 271.50 271.50 270.94 270.93 269.70 269.46 269.28 269.14 269.02 268.93 268.85 268.79	Jet Phase Jet Phase Spillane E $V_{plume}=((Va)_c$ $\theta_p=\theta_n(1+(1$	Squations: - 5.3m/s e - 5.3m/s e 	is the real solution x = 2-zv = or z(m) = z(ft) = ed verywhere	-400.91 -382.9
Height above Ground z _{ent} +h _s Fable of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack. Rel.Ht = 130.0 150.0 200.0 3000.0 4000.0 200.0 3000.0 4000.0 200.0 3000.0 4000.0 6000.0 6000.0 6000.0 7000.0 8000.0 1000.0 11000.0 11000.0 14000.0 15000.0 16000.0 1700.0 1700.0 1800.0 1700.0 1800.0 1900.0 2000.0 2000.0 21000.0 22000.0 2400.0 26000.0 3000.0 3000.0 3000.0 3000.0 3000.0 3000.0 2000.0	#NVA #Iume-average (meters) above stack 0.00 6.10 21.34 51.82 82.30 112.78 143.26 173.74 204.22 234.70 265.18 295.66 325.614 326.54 326.614 326.63 387.10 417.58 428.63 387.10 417.58 60.046 630.94 630.94 639.98 600.46 630.94 639.574 935.74 935.74 935.74 996.70 1105.766 1118.62	meters e e e e e e e e e e e e e e e e e e	#N/A /elocities stat Vert. Vel(m/s) 3.99 3.81 3.69 3.377 3.44 3.322 3.20 3.86 2.96 2.44 2.22 2.00 2.44 2.242 2.12 2.07 2.01 2.001 3.331 3.333 4.14 4.57 4.68 4.72 4.71 4.68 4.64 4.60	feet rting at en Plume Temp(K) 276.01 272.50 271.50 270.94 270.05 270.03 269.46 269.28 269.14 269.02 268.93 268.85	Jet Phase Jet Phase Spillane E $V_{plume}=((Va)_c$ $\theta_p=\theta_n(1+(1$	Squations: - 5.3m/s e - 5.3m/s e 	is the real solution x = 2-zv = or z(m) = z(ft) = ed verywhere	-400.91 -382.9
Height above Ground z _{ent} +h _s Fable of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack. Rel.Ht = 130.0 1500.0 2000.0 3000.0 3000.0 4000.0 5000.0 3000.0 3000.0 4000.0 5000.0 3000.0 4000.0 5000.0 600.0 7000.0 1000.0 1000.0 11000.0 11000.0 12000.0 14000.0 15000.0 16000.0 1700.0 1744.7 70p of jet = 1797.7 18000.0 20000.0 21000.0 22000.0 22000.0 22000.0 28000.0 32000.0 32000.0 32000.0 32000.0 32000.0 32000.0 32000.0 <td>#N/A "Iume-average (meters) above stack 0.00 11.32 21.34 51.82 82.30 112.78 113.26 113.26 113.74 204.22 234.70 265.18 225.66 326.14 326.26.14 326.26.14 326.26.14 326.26.14 326.26.14 326.26.14 326.26.14 326.14 326.14 326.14 327.10 447.854 492.16 509.02 509.02 509.03 509.04 60.04 630.94 630.94 630.94 630.94 630.94 630.94 630.94 935.74 9935.74 9935.74 9935.74 9935.74<</td> <td>meters ed Vertical 1 Plume Radius(m) 40.665 41.153 44.317 44.810 47.248 49.687 52.125 54.564 57.002 59.440 61.879 64.317 66.756 69.194 71.632 74.071 76.509 78.947 78.027 78.570 81.330 78.570 83.324 93.200 98.077 107.831 117.584 127.338 137.092 146.845 156.599 166.352 176.106 185.800 195.613</td> <td>#NVA Velocities stat Vert. Vel(m/s) 3.99 3.33 3.81 3.69 3.57 3.44 3.32 3.20 3.08 2.96 2.84 2.36 2.48 2.36 2.48 2.24 2.00 2.48 2.12 2.007 2.01 3.31 3.83 4.14 4.55 4.68 4.72 4.71 4.68 4.64 4.64 4.60 4.55</td> <td>feet rting at en Plume Temp(K) 276.01 272.50 271.50 271.50 270.94 270.93 269.70 269.46 269.28 269.14 269.02 268.93 268.85 268.79</td> <td>Jet Phase Jet Phase Spillane E $V_{plume}=((Va)_c$ $\theta_p=\theta_n(1+(1$</td> <td>Squations: - 5.3m/s e - 5.3m/s e </td> <td>is the real solution x = 2-zv = or z(m) = z(ft) = ed verywhere</td> <td>-400.91 -382.9</td>	#N/A "Iume-average (meters) above stack 0.00 11.32 21.34 51.82 82.30 112.78 113.26 113.26 113.74 204.22 234.70 265.18 225.66 326.14 326.26.14 326.26.14 326.26.14 326.26.14 326.26.14 326.26.14 326.26.14 326.14 326.14 326.14 327.10 447.854 492.16 509.02 509.02 509.03 509.04 60.04 630.94 630.94 630.94 630.94 630.94 630.94 630.94 935.74 9935.74 9935.74 9935.74 9935.74<	meters ed Vertical 1 Plume Radius(m) 40.665 41.153 44.317 44.810 47.248 49.687 52.125 54.564 57.002 59.440 61.879 64.317 66.756 69.194 71.632 74.071 76.509 78.947 78.027 78.570 81.330 78.570 83.324 93.200 98.077 107.831 117.584 127.338 137.092 146.845 156.599 166.352 176.106 185.800 195.613	#NVA Velocities stat Vert. Vel(m/s) 3.99 3.33 3.81 3.69 3.57 3.44 3.32 3.20 3.08 2.96 2.84 2.36 2.48 2.36 2.48 2.24 2.00 2.48 2.12 2.007 2.01 3.31 3.83 4.14 4.55 4.68 4.72 4.71 4.68 4.64 4.64 4.60 4.55	feet rting at en Plume Temp(K) 276.01 272.50 271.50 271.50 270.94 270.93 269.70 269.46 269.28 269.14 269.02 268.93 268.85 268.79	Jet Phase Jet Phase Spillane E $V_{plume}=((Va)_c$ $\theta_p=\theta_n(1+(1$	Squations: - 5.3m/s e - 5.3m/s e 	is the real solution x = 2-zv = or z(m) = z(ft) = ed verywhere	-400.91 -382.9
Height above Ground z _{ent} +h _s able of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack. Rel.Ht = 130.0 Stack. Rel.Ht = 130.0 1500 3000.0 <tr< td=""><td>#NVA #Iume-average (meters) above stack 0.00 1.134 51.82 82.30 112.78 143.26 173.74 204.22 234.70 265.18 295.66 326.14 356.62 337.10 417.58 448.06 478.54 478.54 478.54 6509.02 559.50 569.98 600.46 630.94 631.92 559.55 569.98 600.46 631.92 559.55 569.98 600.46 631.92 559.55 569.98 600.46 631.92 559.55 569.98 600.46 631.92 559.55 569.98 600.46 631.92 559.55 569.98 600.46 631.92 559.55 569.98 600.46 631.92 559.55 569.98 600.46 631.92 559.55 569.98 600.46 631.92 559.55 569.98 600.46 631.92 559.55 569.98 600.46 631.92 559.55 569.98 600.46 631.92 559.55 569.98 600.46 631.92 559.55 569.98 600.46 631.92 559.55 569.98 600.46 631.92 752.86 813.82 874.78 996.70 1057.66 1118.62 1179.28</td><td>meters ed Vertical 1 Plume Radius(m) 40.665 41.153 44.317 52.125 54.564 57.002 59.440 61.879 64.317 66.756 69.194 71.632 74.071 76.509 78.947 80.037 81.330 78.570 83.3447 88.324 93.200 98.077 107.831 117.584 127.338 137.092 146.6352 176.106 185.860 185.860</td><td>#NVA Velocities stat Vert. Vel(m/s) 3.99 3.33 3.81 3.69 3.57 3.44 3.32 3.08 2.60 2.84 2.36 2.84 2.36 2.84 2.33 3.08 2.84 2.36 2.84 2.33 3.83 4.14 4.33 4.57 4.68 4.72 4.71 4.68 4.64 4.60 4.55</td><td>feet rting at en Plume Temp(K) 276.01 272.50 271.50 271.50 270.94 270.94 270.93 269.70 269.28 269.28 269.28 268.85 268.85 268.87 268.73</td><td>Jet Phase Jet Phase Spillane E $V_{plume}=((Va)_c$ $\theta_p=\theta_n(1+(1$</td><td>Squations: - 5.3m/s e - 5.3m/s e </td><td>is the real solution x = 2-zv = or z(m) = z(ft) = ed verywhere</td><td>-400.91 -382.9</td></tr<>	#NVA #Iume-average (meters) above stack 0.00 1.134 51.82 82.30 112.78 143.26 173.74 204.22 234.70 265.18 295.66 326.14 356.62 337.10 417.58 448.06 478.54 478.54 478.54 6509.02 559.50 569.98 600.46 630.94 631.92 559.55 569.98 600.46 631.92 559.55 569.98 600.46 631.92 559.55 569.98 600.46 631.92 559.55 569.98 600.46 631.92 559.55 569.98 600.46 631.92 559.55 569.98 600.46 631.92 559.55 569.98 600.46 631.92 559.55 569.98 600.46 631.92 559.55 569.98 600.46 631.92 559.55 569.98 600.46 631.92 559.55 569.98 600.46 631.92 559.55 569.98 600.46 631.92 559.55 569.98 600.46 631.92 559.55 569.98 600.46 631.92 559.55 569.98 600.46 631.92 752.86 813.82 874.78 996.70 1057.66 1118.62 1179.28	meters ed Vertical 1 Plume Radius(m) 40.665 41.153 44.317 52.125 54.564 57.002 59.440 61.879 64.317 66.756 69.194 71.632 74.071 76.509 78.947 80.037 81.330 78.570 83.3447 88.324 93.200 98.077 107.831 117.584 127.338 137.092 146.6352 176.106 185.860 185.860	#NVA Velocities stat Vert. Vel(m/s) 3.99 3.33 3.81 3.69 3.57 3.44 3.32 3.08 2.60 2.84 2.36 2.84 2.36 2.84 2.33 3.08 2.84 2.36 2.84 2.33 3.83 4.14 4.33 4.57 4.68 4.72 4.71 4.68 4.64 4.60 4.55	feet rting at en Plume Temp(K) 276.01 272.50 271.50 271.50 270.94 270.94 270.93 269.70 269.28 269.28 269.28 268.85 268.85 268.87 268.73	Jet Phase Jet Phase Spillane E $V_{plume}=((Va)_c$ $\theta_p=\theta_n(1+(1$	Squations: - 5.3m/s e - 5.3m/s e 	is the real solution x = 2-zv = or z(m) = z(ft) = ed verywhere	-400.91 -382.9
Height above Ground z _{ent} +h _s Fable of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.H = 130.0 150.0 200.0	#NVA #Iume-average (meters) above stack 0.00 6.10 21.34 51.82 82.30 112.78 143.26 173.74 204.22 234.70 265.18 295.66 326.14 356.62 387.10 417.58 448.06 478.54 492.16 509.02 539.50 539.50 569.98 600.46 630.44 639.57 492.57 1057.66 1118.62 1179.58 1240.54 1240.54 1240.54 1240.55 12	meters ed Vertical 1 Plume Radius(m) 40.665 41.153 42.372 44.810 47.248 49.687 52.125 54.544 57.002 59.440 61.879 64.317 66.756 69.194 71.632 74.071 76.502 74.071 76.502 78.570 83.447 88.324 93.200 98.077 107.831 117.548 127.38	#NVA /relocities stat Vert. Vel(m/s) 3.99 3.81 3.69 3.57 3.44 3.32 3.20 3.08 2.84 2.72 2.60 2.84 2.33 2.24 2.12 2.07 2.01 2.06 3.31 3.33 4.14 4.57 4.68 4.72 4.77 4.68 4.64 4.65 4.55	feet rting at en Plume Temp(K) 276.01 272.55 270.03 271.50 270.94 270.55 270.03 269.46 269.28 269.14 269.28 268.85 268.79 269.79 269	Jet Phase Jet Phase Spillane E $V_{plume}=((Va)_c$ $\theta_p=\theta_n(1+(1$	Squations: - 5.3m/s e - 5.3m/s e 	is the real solution x = 2-zv = or z(m) = z(ft) = ed verywhere	-400.91 -382.9



	r PEP ACC w "Aviation Sa							
		-				litions at V	arious Heights in the Plume	
	ine Evaluat		•				Australia," Dr. K.T. Spilla	
		from a Gas-	I urbine Pow		-			
Ambient Conditions:					Constants:		eutral conditions (dθ/dz=0 or	⊎ _a =⊎ _e)
Ambient Potential Temp θ _a	290.93	Kelvins	64.0	۳F	0.1		meters/feet	
Plume Exit Conditions:					Gravity g		m/s ²	
Stack Height h _s	39.62	meters	130.0	feet	λ	1.11		
Stack Diameter D	81.3297	meters	266.83	feet	λο	~1.0		
Stack Velocity V _{exit}	5.67	m/s	18.60	ft/sec				
Volumetric Flow	29,455.83	cu.m/sec	62,413,371	ACFM	$\pi V_{exit} D^2/4$			Sect.2/¶1
Stack Potential Temp θ _s	305.55	Kelvins	90.32	°F				
Initial Stack Buoyancy Flux Fo	4,401.04	m ⁴ /s ³			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)
Conditions at End (Top) of Jet Phase:								
Height above Stack z _{iet}	508.311	meters*	1667.7	feet*	7: = 6 25) meters*=	meters above stack top	Sect.3/¶1
Height above Ground z _{jet} +h _s	547.931		1797.7			, 11101010 =		
					V 0.5V	N/ /0		
Vertical Velocity V _{jet}	2.835			ft/sec	V _{jet} = 0.5V	_{exit} = V _{exit} /2	0	
Plume Top-Hat Diameter 2a _{jet}	162.659	meters	533.7	teet	$2a_{jet} = 2D$		Conservation of momentum	
Spillane Methodology - Analytical Solutions f	or Calm Con	ditions for PI	ume Heights	above Jet	Phase			
Single Plume-averaged Vertical Velocity	V given by Ar	nalytical Solu	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 inc	crease with height	Sect.2/Eq.
Virtual Source Height z _v	12.310	meters*	40.4	feet*	6.25D[1-(θ _e	$(\theta_{s})^{1/2}$], met	ers*=meters above stack top	Sect.2/Eq.
Height above Ground zv+hs	51.930	meters	170.4	feet			where $(\theta_a/\theta_s)^{1/2} = (\theta_e/\theta_s)^{1/2} =$	0.9758
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(
Product (Va) _o	224.986				V _{exit} D/2(θ _e /			```
Solve for plume-averaged vertical velo	city at height	1,500.0	feet	457 2	meters abo	ve ground (z'+h_)	
Gives the following Height above Stack z'	417.580		1370.0				ntered < Top of Jet - Cann	nt Be Selv
Gives the following Height above Stack 2 Plume Top-Hat Diameter 2a'		meters	1370.0 #N/A		20-210 40		increa < rop or jet - canno	Sect.2/Eq.
					2a'=2*0.16		2 (0.05D 21)(1/3)((0.10)	
Vertical Velocity V	#N/A	m/s	#N/A	ft/sec	V={(Va) _o °+	0.12⊦₀[(z-z,	/) ² -(6.25D-z _v) ²]} ^(1/3) /(2a'/2)	Sect.2/Eq.
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 z _{crit} +h _s	#N/A	meters	#N/A	feet	for V=4.3 n	n/s using th	e cubic equation ax ³ +bx ² +cx	+d=0, whe
						a=1, c=0,	and b=-(0.12F _o)/(4.3 ³ 0.16 ³)=	-866.06
Interpolated Height of critical vertical ve	elocity in Jet	Phase:			and o	=[0.12F _o (6.	$(25D-z_v)^2 - (Va)_0^3]/(4.3^30.16^3) =$	1943900
Find Height above Stack z _{crit}	66.340	meters	217.7	feet			http://www.1728.	org/cubic.h
-								
Height above Ground z _{crit} +h _e	105,960	meters	347.6			aive	s the real solution x = z-zv =	-392.93
Height above Ground z _{crit} +h _s	105.960	meters	347.6			give	s the real solution x = z-zv =	-392.93
				feet	d of ict phy		or z(m) =	-380.6
Table of Plume Top-Hat Diameters (2a) and P	lume-averag	ed Vertical \	/elocities sta	feet rting at en	d of jet pha			
Table of Plume Top-Hat Diameters (2a) and P Height (feet)	lume-averag (meters)	ed Vertical \ Plume	/elocitiessta Vert.	feet rting at en Plume			or z(m) =	-380.6
Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground	lume-averag (meters) above stack	ed Vertical \ Plume Radius(m)	/elocitiessta Vert. Vel(m/s)	feet rting at en Plume		ase:	or z(m) = z(ft) =	-380.
Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground <u>Stack.Rel.Ht</u> = 130.0	lume-averag (meters) above stack <u>0.00</u>	ed Vertical \ Plume Radius(m) 40.665	/elocities sta Vert. Vel(m/s) 5.67	feet rting at en Plume			or z(m) = z(ft) =	-380.
Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground <u>Stack.Rel. Ht = 130.0</u> 150.0	lume-averag (meters) above stack <i>0.00</i> 6.10	ed Vertical V Plume Radius(m) 40.665 41.153	/elocities sta Vert. Vel(m/s) 5.67 5.64	feet rting at en Plume	Jet Phase	ase: /Interpolate	or z(m) = z(ft) =	-380.
Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground <i>Stack.Rel.Ht</i> = 130.0 150.0 200.0	lume-averag (meters) above stack <i>0.00</i> 6.10 21.34	ed Vertical V Plume Radius(m) 40.665 41.153 42.372	/elocities sta Vert. Vel(m/s) 5.64 5.55	feet rting at en Plume	Jet Phase	ase: /Interpolate	or z(m) = z(ft) =	-380.
Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground <u>Stack.Rel. Ht = 130.0</u> 150.0	lume-averag (meters) above stack <i>0.00</i> 6.10	ed Vertical V Plume Radius(m) 40.665 41.153	/elocities sta Vert. Vel(m/s) 5.67 5.64	feet rting at en Plume	Jet Phase	ase: /Interpolate	or z(m) = z(ft) =	-380.
Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground <i>Stack. Rel. Ht</i> = 130.0 150.0 200.0	lume-averag (meters) above stack <i>0.00</i> 6.10 21.34	ed Vertical V Plume Radius(m) 40.665 41.153 42.372	/elocities sta Vert. Vel(m/s) 5.64 5.55	feet rting at en Plume	Jet Phase	ase: /Interpolate	or z(m) = z(ft) =	-380.
Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground <i>Stack.Rel.Ht</i> = 130.0 150.0 200.0 300.0	lume-averag (meters) above stack <i>0.00</i> 6.10 21.34 51.82	ed Vertical V Plume Radius(m) 40.665 41.153 42.372 44.810	/elocities sta Vert. Vel(m/s) 5.64 5.55 5.38	feet rting at en Plume	Jet Phase	ase: /Interpolate	or z(m) = z(ft) =	-380.
Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground <i>Stack.Rel.Ht</i> = 130.0 1500.0 200.0 300.0 400.0	lume-averag (meters) above stack 0.00 6.10 21.34 51.82 82.30	ed Vertical \ Plume Radius(m) 40.665 41.153 42.372 44.810 47.248	/elocities sta Vert. Vel(m/s) 5.64 5.55 5.38 5.21	feet rting at en Plume	Jet Phase	ase: /Interpolate	or z(m) = z(ft) =	-380.
Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 130.0 1500.0 200.0 300.0 400.0	lume-averag (meters) above stack 0.00 6.10 21.34 51.82 82.30 112.78	ed Vertical \ Plume Radius(m) 40.665 41.153 42.372 44.810 47.248 49.687	/elocities sta Vert. Vel(m/s) 5.64 5.55 5.38 5.21 5.04	feet rting at en Plume	Jet Phase	ase: /Interpolate	or z(m) = z(ft) =	-380.
Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack. Rel. Ht = 130.0 200.0 300.0 400.0 500.0 700.0	lume-averag (meters) above stack 0.00 6.10 21.34 51.82 82.30 112.78 143.26 173.74	ed Vertical V Plume Radius(m) 40.665 41.153 42.372 44.810 47.248 49.687 52.125 54.564	/elocities sta Vert. Vel(m/s) 5.67 5.64 5.55 5.38 5.21 5.04 4.87 4.70	feet rting at en Plume	Jet Phase	ase: /Interpolate	or z(m) = z(ft) =	-380.
Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack. Rel. Ht = 130.0 200.0 300.0 400.0 500.0 600.0 700.0 800.0	lume-averag (meters) above stack 0.00 6.10 21.34 51.82 82.30 112.78 143.26 173.74 204.22	ed Vertical V Plume Radius(m) 40.665 41.153 42.372 44.810 47.248 49.687 52.125 54.564 57.002	/elocities sta Vert. Vel(m/s) 5.67 5.64 5.55 5.38 5.21 5.04 4.87 4.70 4.53	feet rting at en Plume Temp(K)	Jet Phase	ase: /Interpolate	or z(m) = z(ft) =	-380.
Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 130.0 200.0 300.0 400.0 500.0 600.0 700.0 800.0 900.0	lume-averag (meters) above stack 0.00 6.10 21.34 51.82 82.30 112.78 143.26 173.74 204.22 234.70	ed Vertical V Plume Radius(m) 40.665 41.153 42.372 44.810 47.248 49.687 52.125 54.564 554.564 57.002 59.440	/elocities sta Vert. Vel(m/s) 5.64 5.55 5.38 5.21 5.04 4.87 4.70 4.53 4.36	feet rting at en Plume Temp(K)	Jet Phase	ase: /Interpolate	or z(m) = z(ft) =	-380.
Stack. Rel. Ht Stack.	lume-averag (meters) above stack 0.00 6.10 21.34 51.82 82.30 112.78 143.26 173.74 204.22 234.70 265.18	ed Vertical M Plume Radius(m) 40.665 41.153 42.372 44.810 47.248 49.687 52.125 54.564 57.002 59.440 61.879	/elocities sta Vert. Vel(m/s) 5.67 5.64 5.55 5.38 5.21 5.04 4.87 4.70 4.83 4.36 4.33 4.36	feet rting at en Plume Temp(K)	Jet Phase	ase: /Interpolate	or z(m) = z(ft) =	-380.
Stack. Rel. Ht Stack.	lume-averag (meters) above stack 0.000 6.10 21.34 51.82 82.30 112.78 1143.26 173.74 204.22 234.70 265.18 295.66	ed Vertical N Plume Radius(m) 40.665 41.153 42.372 44.810 47.248 49.687 52.125 54.564 57.002 59.440 61.879 64.317	/elocities sta Vert. Vel(m/s) 5.64 5.55 5.38 5.21 5.04 4.87 4.70 4.53 4.36 4.99 4.99 4.99 4.02	feet rting at en Plume Temp(K)	Jet Phase	ase: /Interpolate	or z(m) = z(ft) =	-380.
Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack. Rel. Ht = 130.0 200.0 300.0 400.0 500.0 600.0 700.0 800.0 900.0 1100.0 1100.0 1200.0	lume-averag (meters) above stack 0.000 6.10 21.34 51.82 82.30 112.78 1143.26 173.74 204.22 2334.70 225.18 225.66 326.14	ed Vertical N Plume Radius(m) 40.665 41.153 42.372 44.810 47.248 49.687 52.125 54.564 57.002 59.440 61.879 64.317 66.756	/elocities sta Vert. Vel(m/s) 5.64 5.55 5.38 5.21 5.04 4.87 4.70 4.53 4.36 4.19 4.30 4.30 4.33 8.55	feet rting at en Plume Temp(K)	Jet Phase	ase: /Interpolate	or z(m) = z(ft) =	-380.
Stack. Rel. Ht Stack.	lume-averag (meters) above stack 0.00 6.10 21.34 51.82 82.30 112.78 143.26 234.70 265.18 225.66 326.61 3266.62	ed Vertical M Plume Radius(m) 40.665 41.153 42.372 44.810 47.248 49.687 52.125 54.564 57.002 59.440 61.879 64.317 66.756 669.194	/elocities sta Vert. Vel(m/s) 5.67 5.55 5.38 5.51 5.04 4.87 4.70 4.53 4.36 4.19 4.02 3.855 3.68	feet rting at en Plume Temp(K)	Jet Phase	ase: /Interpolate	or z(m) = z(ft) =	-380.
Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack. Rel. Ht = 130.0 200.0 300.0 400.0 500.0 600.0 700.0 800.0 900.0 1100.0 1100.0 1200.0	lume-averag (meters) above stack 0.000 6.10 21.34 51.82 82.30 112.78 1143.26 173.74 204.22 2334.70 225.18 225.66 326.14	ed Vertical N Plume Radius(m) 40.665 41.153 42.372 44.810 47.248 49.687 52.125 54.564 57.002 59.440 61.879 64.317 66.756	/elocities sta Vert. Vel(m/s) 5.64 5.55 5.38 5.21 5.04 4.87 4.70 4.53 4.36 4.19 4.30 4.30 4.33 8.55	feet rting at en Plume Temp(K)	Jet Phase	ase: /Interpolate	or z(m) = z(ft) =	-380.
Stack. Rel. Ht Stack.	lume-averag (meters) above stack 0.00 6.10 21.34 51.82 82.30 112.78 143.26 234.70 265.18 225.66 326.61 3266.62	ed Vertical M Plume Radius(m) 40.665 41.153 42.372 44.810 47.248 49.687 52.125 54.564 57.002 59.440 61.879 64.317 66.756 669.194	/elocities sta Vert. Vel(m/s) 5.67 5.55 5.38 5.51 5.04 4.87 4.70 4.53 4.36 4.19 4.02 3.855 3.68	feet rting at en Plume Temp(K)	Jet Phase	ase: /Interpolate	or z(m) = z(ft) =	-380.
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Stack. Rel. Ht Stack.	lume-averag (meters) above stack 0.000 6.10 21.34 51.82 82.30 112.78 143.26 173.74 204.22 234.70 2265.18 225.66 326.14 326.62 337.10 357.10 237.70 247.70 265.31 225.66 237.14 25.66 237.14 25.66 237.14 25.66 237.14 25.66 237.14 25.66 237.14 25.66 237.14 25.66 25.66 237.14 25.66 25.76 25.7	ed Vertical N Plume Radius(m) 40.665 41.153 42.372 44.810 47.248 49.687 52.125 54.564 57.002 59.440 61.879 64.317 66.756 69.194 71.632 74.071	/elocities sta Vert. Vel(m/s) 5.64 5.55 5.38 5.21 5.04 4.87 4.70 4.53 4.53 4.53 4.36 3.85 3.68 3.51 3.34	feet rting at en Plume Temp(K)	Jet Phase	ase: /Interpolate	or z(m) = z(ft) =	-380.
Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack. Rel. Ht = 130.0 200.0 300.0 400.0 50.0 600.0 700.0 800.0 900.0 1100.0 1200.0 1300.0 1100.0 1200.0 1300.0 1400.0 1200.0 1300.0 1400.0 1500.0 1600.0 1700.0	lume-averag (meters) above stack 0.000 6.10 21.34 51.82 82.30 112.78 1143.26 173.74 204.22 234.70 265.18 2265.66 3326.14 356.62 3387.10 417.58 448.60 478.54	ed Vertical N Plume Radius(m) 40.665 41.153 42.372 44.810 47.248 49.687 52.125 54.564 55.125 54.564 57.002 59.440 61.879 64.317 66.756 69.194 71.632 74.071 76.509 78.947	/elocities sta Vert. Vel(m/s) 5.64 5.55 5.38 5.21 5.04 4.87 4.70 4.53 4.470 4.53 4.49 4.02 3.85 3.68 3.51 3.34 3.51 3.34	feet rting at en Plume Temp(K)	Jet Phase	ase: /Interpolate	or z(m) = z(ft) =	-380.
Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack. Rel. Ht = 130.0 200.0 300.0 400.0 500.0 300.0 400.0 500.0 300.0 400.0 500.0 600.0 700.0 800.0 900.0 1100.0 1200.0 1300.0 1400.0 1500.0 1700.0 1700.0	lume-averag (meters) above stack 0.00 6.10 21.34 51.82 82.30 112.78 143.26 173.74 2204.22 2334.70 265.18 225.66 3326.14 3326.14 356.62 3387.10 417.58 448.06 478.54 492.16	ed Vertical A Plume Radius(m) 40.665 41.153 42.372 44.810 47.248 49.687 52.125 54.564 57.002 59.440 61.879 64.317 66.756 69.194 71.632 74.071 76.509 78.947 80.037	/elocities sta Vert. Vel(m/s) 5.67 5.55 5.38 5.55 5.38 5.21 5.04 4.87 4.70 4.53 4.36 4.36 4.36 3.41 3.34 3.34 3.317 3.300 2.93	feet rting at en Plume Temp(K)	Jet Phase	/interpolate > 5.3m/s u	or z(m) = z(ft) =	-380.
Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack. Rel. Ht = 130.0 Stack. Rel. Ht = 130.0 200.0 300.0 300.0 600.0 700.0 000.0 1000.0 1000.0 1000.0 1000.0 1000.0 1000.0 1000.0 1000.0 1000.0 1000.0 1000.0 1000.0 1000.0 1000.0 1000.0 1000.0 1400.0 1500.0 1600.0 1704.7 Top of jet = 1797.7	lume-averag (meters) above stack 0.000 6.10 21.34 51.82 82.30 1112.78 1143.26 21.37 20.112.78 20.122 20.170 20.65.18 22.95.66 32.6.14 25.66 32.6.14 35.662 3387.10 417.58 448.06 4478.54 449.2.16 508.32	ed Vertical N Radius(m) 40.665 41.153 42.372 44.810 47.248 49.687 52.125 54.564 57.002 59.440 61.879 64.317 66.756 69.194 71.632 74.071 76.509 78.947 80.037 81.330	/elocities sta Vert. Vel(m/s) 5.64 5.55 5.38 5.21 5.04 4.87 4.70 4.53 4.53 4.53 4.53 4.36 3.86 3.361 3.364 3.351 3.34 3.371 3.300 2.233 2.84	feet rting at en Plume Temp(K)	Jet Phase	iquations:	or z(m) = z(ft) =	-380.
Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack. Rel. Ht = 130.0 2000.0 3000.0 3000.0 400.0 500.0 600.0 700.0 8000.0 1000.0 1000.0 1000.0 1000.0 1000.0 1000.0 1000.0 1000.0 1000.0 1000.0 1200.0 1300.0 1700.0 1700.0 1700.0 1700.0 1700.0 1700.0 1700.0 1700.0 1700.0 1700.0 1700.0 1700.0 1700.0 1700.0 1700.0 174.7 1700 of jet = 1797.7 1800.0	lume-averag (meters) above stack 0.000 6.10 21.34 51.82 82.30 112.78 143.26 113.77 245.70 265.18 295.66 326.14 356.62 387.10 417.58 448.06 478.54 492.16 508.32 509.02	ed Vertical N Plume Radius(m) 40.665 41.153 42.372 44.810 47.248 49.667 52.125 54.564 57.002 59.440 61.879 64.317 66.756 69.194 71.632 74.071 76.509 78.947 80.037 81.330 79.474	/elocities sta Vert. Vel(m/s) 5.64 5.55 5.38 5.21 5.04 4.87 4.70 4.53 4.36 4.53 4.36 3.68 3.68 3.68 3.31 3.34 3.34 3.32 3.284 2.86	feet rting at en Plume Temp(K)	Jet Phase	ase: /Interpolate > 5.3m/s u	or z(m) = z(ft) =	-380.
Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack. Rel. Ht = 130.0 200.0 300.0 300.0 400.0 500.0 600.0 700.0 800.0 900.0 100.0 1100.0 1200.0 1300.0 1400.0 150.0 1600.0 1700.0 1700.0 1700.0 1700.0 1700.0 1700.0 1700.0 1700.0 1700.0 1700.0 1700.0 1700.0 1700.0 1744.7 1700.0 1800.0 1900.0	lume-averag (meters) above stack 0.000 6.10 21.34 51.82 82.30 112.78 24.30 112.78 24.30 24.51 22.34.70 265.18 2295.66 326.14 356.62 387.10 417.58 448.06 447.854 449.216 508.02 539.50	ed Vertical N Plume Radius(m) 40.665 41.153 42.372 44.810 47.248 49.687 52.125 54.564 57.002 59.440 61.879 64.317 66.756 69.194 71.632 74.071 76.509 78.947 80.037 81.330 79.474 84.350	/elocities sta Vert. Vel(m/s) 5.64 5.55 5.38 5.21 5.64 4.87 4.70 4.53 4.487 4.70 4.53 4.49 4.02 3.85 3.68 3.61 3.343 3.17 3.00 2.93 2.84 2.86 3.61	feet rting at en Plume Temp(K) 296.79 295.05	Jet Phase, Jet Phase Spillane E V _{plume} =(Va), a = 0.16(z-	ase : /Interpolatu > 5.3m/s u 	or z(m) = z(ft) = ed p to ~350'agl	-380.
Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack. Rel. Ht = 130.0 200.0 300.0 400.0 600.0 700.0 800.0 9000.0 1100.0 1200.0 1300.0 1400.0 150.0 1000.0 1000.0 1100.0 1200.0 1300.0 1400.0 1500.0 1744.7 Top of jet = 1797.7 1800.0 1900.0 2000.0	lume-averag (meters) above stack 0.000 6.10 21.34 51.82 82.30 112.78 24.32 24.70 225.18 2295.66 326.14 356.62 387.10 447.85 448.04 245.18 509.02 539.00 559.90	ed Vertical N Plume Radius(m) 40.665 41.153 42.372 44.810 47.248 49.687 52.125 54.564 57.002 59.440 61.879 64.317 66.756 69.194 71.632 74.071 76.509 78.947 80.037 81.330 97.9.474 84.350 89.227	/elocities sta Vert. Vel(m/s) 5.64 5.55 5.38 5.21 5.44 4.87 4.70 4.53 4.470 4.53 4.470 4.53 4.365 3.868 3.51 3.34 3.51 3.34 3.717 3.000 2.93 2.84 2.866 3.616 4.401	feet rting at en Plume Temp(K) 296.79 295.05 294.25	Jet Phase Jet Phase Vplume=((Va), a = 0.16(c = a) a = 0.16(c = b) = θ_a(1+(1 = b))	ase : /Interpolatu > 5.3m/s u 	or z(m) = z(ft) =	-380.
Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack.Rel.Ht = 130.0 Stack.Rel.Ht = 130.0 200.0 300.0 300.0 400.0 500.0 600.0 700.0 900.0 1000.0 1100.0 1200.0 1300.0 1400.0 1500.0 1600.0 1744.7 Top of jet = 1797.7 1800.0 1900.0 1200.0 2000.0 2000.0	lume-averag (meters) above stack 0.000 6.10 21.34 51.82 82.30 1112.78 113.26 113.73 74 204.22 234.70 265.18 295.66 326.14 326.54 326.14 336.62 3387.10 447.85 448.06 509.02 539.50 539.50 569.98 600.46	ed Vertical N Radius(m) 40.665 41.153 42.372 42.372 52.125 54.564 57.002 59.440 61.879 64.317 66.756 69.194 71.632 74.071 76.509 78.947 80.037 81.330 79.474 84.350 89.227 94.104	/elocities sta Vert. Vel(m/s) 5.64 5.55 5.28 5.21 5.04 4.87 4.70 4.53 4.36 4.70 4.53 4.36 3.85 3.86 3.351 3.34 3.317 3.300 2.93 2.84 2.86 3.61 4.01 4.01 4.25	feet rting at en Plume Temp(K) 296.79 295.05 294.25 293.74	Jet Phase Jet Phase Spillane E V _{plum} =((V3), a = 0.16(z- 0p=0n(1+(1	ase : /Interpolatu > 5.3m/s u 	or z(m) = z(ft) = ed p to ~350'agl	-380.
Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack. Rel. Ht = 130.0 Stack. Rel. Ht = 130.0 200.0 3000.0 3000.0 3000.0 600.0 700.0 000.0 1000.0 1000.0 1000.0 1000.0 1000.0 1000.0 1000.0 1000.0 1000.0 1000.0 1000.0 1100.0 1200.0 1400.0 1500.0 1600.0 1744.7 Top of jet = 1797.7 1800.0 1900.0 2000.0 2100.0	lume-averag (meters) above stack 0.000 6.10 21.34 51.82 82.30 112.78 24.32 24.70 225.18 2295.66 326.14 356.62 387.10 447.85 448.04 245.18 509.02 539.00 559.90	ed Vertical N Plume Radius(m) 40.665 41.153 42.372 44.810 47.248 49.687 52.125 54.564 57.002 59.440 61.879 64.317 66.756 69.194 71.632 74.071 76.509 78.947 80.037 81.330 97.9.474 84.350 89.227	/elocities sta Vert. Vel(m/s) 5.64 5.55 5.38 5.21 5.44 4.87 4.70 4.53 4.470 4.53 4.470 4.53 4.365 3.868 3.51 3.34 3.51 3.34 3.717 3.000 2.93 2.84 2.866 3.616 4.401	feet rting at en Plume Temp(K) 296.79 295.05 294.25 293.74 293.38	Jet Phase Jet Phase Jet Phase Spillane E V _{plum} ={(Va), a = 0.16(z- θ _p =θ ₈ (1+(1	ase : /Interpolatu > 5.3m/s u 	or z(m) = z(ft) = ed p to ~350'agl	-380.
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Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack. Rel. IH = 130.0 Stack. Rel. IH = 130.0 200.0 3000.0 3000.0 3000.0 600.0 700.0 600.0 700.0 900.0 1000.0 1100.0 1200.0 1000.0 1100.0 1200.0 1200.0 1400.0 1500.0 1600.0 1744.7 Top of jet = 1797.7 1800.0 1900.0 2200.0 2400.0 2200.0 2400.0 2400.0 2400.0 3400.0 3400.0 3400.0 3400.0 3400.0 3400.0 3400.0 3400.0 3400.0 3400.0 3400.0 <td< td=""><td>lume-averag (meters) above stack 0.000 6.10 21.34 51.82 82.30 1112.78 143.26 1773.74 204.22 234.70 265.18 225.66 226.14 326.62 337.10 417.58 448.06 478.54 448.06 478.54 509.02 539.50 569.98 600.46 630.94 663.09 669.98 600.46 133.82 874.78 935.74 995.77 995.76 11118.62</td><td>ed Vertical N Radius(m) 40.665 41.153 42.372 44.810 47.248 49.687 52.125 54.564 57.002 59.440 61.879 64.317 66.756 69.194 71.632 74.071 76.509 78.947 80.037 81.330 79.474 84.350 89.227 94.104 98.981 108.734 218.222 117.710 128.7502 147.749 157.502 157.502 1</td><td>/elocities sta Vert. Vel(m/s) 5.67 5.64 5.55 5.38 5.21 5.04 4.87 4.70 4.53 4.36 3.45 3.86 3.61 3.34 4.33 7.7 3.00 2.93 2.84 2.86 3.61 4.01 4.25 4.42 4.60 4.61 4.65 4.45 7.4.55</td><td>feet rting at en Plume Temp(K) 296.79 296.79 294.25 293.74 293.38 292.88 292.54 293.74 293.38 292.54 293.74 293.75 291</td><td>Jet Phase Jet Phase Jet Phase V_{plum}=((Va)) a = 0.16(z- θ_p=θ_n(1+(1) Max<5.3 n</td><td>3se : /Interpolatu > 5.3m/s u </td><td>or z(m) = z(ft) = ed p to ~350'agl</td><td>-380.</td></td<>	lume-averag (meters) above stack 0.000 6.10 21.34 51.82 82.30 1112.78 143.26 1773.74 204.22 234.70 265.18 225.66 226.14 326.62 337.10 417.58 448.06 478.54 448.06 478.54 509.02 539.50 569.98 600.46 630.94 663.09 669.98 600.46 133.82 874.78 935.74 995.77 995.76 11118.62	ed Vertical N Radius(m) 40.665 41.153 42.372 44.810 47.248 49.687 52.125 54.564 57.002 59.440 61.879 64.317 66.756 69.194 71.632 74.071 76.509 78.947 80.037 81.330 79.474 84.350 89.227 94.104 98.981 108.734 218.222 117.710 128.7502 147.749 157.502 157.502 1	/elocities sta Vert. Vel(m/s) 5.67 5.64 5.55 5.38 5.21 5.04 4.87 4.70 4.53 4.36 3.45 3.86 3.61 3.34 4.33 7.7 3.00 2.93 2.84 2.86 3.61 4.01 4.25 4.42 4.60 4.61 4.65 4.45 7.4.55	feet rting at en Plume Temp(K) 296.79 296.79 294.25 293.74 293.38 292.88 292.54 293.74 293.38 292.54 293.74 293.75 291	Jet Phase Jet Phase Jet Phase V _{plum} =((Va)) a = 0.16(z- θ _p =θ _n (1+(1) Max<5.3 n	3se : /Interpolatu > 5.3m/s u 	or z(m) = z(ft) = ed p to ~350'agl	-380.
Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack. Rel. IH = 130.0 2000.0 3000.0 3000.0 3000.0 3000.0 400.0 500.0 600.0 700.0 800.0 1000.0 1100.0 1200.0 1300.0 1400.0 1500.0 1600.0 1700.0 1700.0 1800.0 1700.0 1800.0 1700.0 1200.0 1200.0 1200.0 1200.0 1200.0 1200.0 1200.0 1200.0 1200.0 1200.0 1200.0 1200.0 1200.0 1200.0 2000.0 2000.0 2000.0 2000.0 2000.0 <	lume-averag (meters) above stack 0.000 6.10 21.34 51.82 82.30 112.78 143.26 173.74 204.22 234.70 2265.18 295.66 326.14 356.62 337.10 417.58 448.06 478.54 492.16 509.02 539.50 569.93 509.02 539.50 569.93 600.44 630.94 63	ed Vertical N Plume Radius(m) 40.665 41.153 42.372 44.810 47.248 49.687 52.125 54.564 57.002 59.440 61.879 64.317 66.756 69.194 71.632 74.071 76.509 78.947 80.037 81.330 79.474 84.350 89.227 94.104 98.981 108.734 118.488 128.242 137.995 147.749 157.502 167.256 147.749 157.502 167.256 177.010 166.756 177.010 166.755 196.517 197.517 197.	/elocities sta Vert. Vel(m/s) 5.64 5.55 5.38 5.21 5.44 4.87 4.70 4.53 4.36 3.43 3.68 3.51 3.34 4.30 2.93 2.24 2.86 3.61 4.01 4.22 4.60 4.61 4.71 4.65 4.42 4.65 4.65 4.65	feet rting at en Plume Temp(K) 296.79 295.05 294.25 293.74 293.38 292.88 292.54 293.38 292.54 293.38 292.11 291.97 291.85 291.75 291.60 291.54	Jet Phase Jet Phase Jet Phase Spillane E V _{plume} =(Va), a = 0.16(z- φ _p =θ _n (1+(1) Max<5.3 n	3se : /Interpolatu > 5.3m/s u 	or z(m) = z(ft) = ed p to ~350'agl	-380.
Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack. Rel. IH = 130.0 2000.0 300.0 300.0 300.0 400.0 500.0 600.0 700.0 800.0 900.0 1000.0 1100.0 1200.0 1300.0 1400.0 150.0 1600.0 1700.0 1800.0 1700.0 1800.0 1700.0 1800.0 1900.0 2000.0 2000.0 2000.0 2000.0 2000.0 2000.0 2000.0 2000.0 2000.0 2000.0 2000.0 2000.0 2000.0 2000.0 2000.0 2000.0 2000.0 2000.0	lume-averag (meters) above stack 0.000 6.10 21.34 51.82 82.30 112.78 24.30 112.78 24.30 225.18 2254.70 225.18 2254.70 225.18 2254.70 225.18 2255.66 236.71 255.66 236.71 255.65 238.71 0 417.55 509.02 509.02 539.50 569.98 600.46 650.32 509.02 539.50 569.98 600.46 651.90 559.50 569.98 600.46 651.90 559.50 569.98 600.46 651.90 559.50 569.98 600.46 651.90 559.50 569.98 600.46 651.90 559.50 569.98 600.46 651.90 559.50 569.98 600.46 651.90 559.50 569.98 600.46 651.90 559.50 569.98 600.46 651.90 559.50 569.98 600.46 651.90 559.50 569.98 600.46 651.90 559.50	ed Vertical N Plume Radius(m) 40.665 41.153 42.372 44.810 47.248 49.687 52.125 54.564 57.002 59.440 61.879 64.317 66.756 69.194 71.632 74.071 76.509 78.947 80.037 81.330 79.474 80.337 79.474 81.330 79.474 81.330 79.474 81.330 79.474 81.327 81.327 81.327 81.327 81.327 81.327 81.327 81.327 81.327 81.327 81.327 81.327 81.327 81.327 81.327 81.557 85.55	/elocities sta Vert. Vel(m/s) 5.64 5.55 5.38 5.21 5.64 4.87 4.70 4.53 4.36 3.68 3.61 3.34 2.86 3.61 4.99 4.02 3.85 3.68 3.61 4.90 4.02 3.85 3.68 3.61 4.00 4.02 2.86 3.61 4.10 4.25 4.42 4.65 4.41 4.57 4.42 4.57 4.42 4.57 4.42 4.57 4.42 4.57 4.42 4.57 4.42 4.57 4.42 4.57 4.42 4.57 4.42 4.57 4.42 4.57 4.53 4.53 4.53 4.53 4.53 4.53 4.53 4.53	feet rting at en Plume Temp(K) 296.79 295.05 294.25 293.74 292.30 292.30 292.14 292.30 292.175 291.67 291.67 291.67 291.64 291.49	Jet Phase Jet Phase Spillane E V _{plume} =(Va), a = 0.16(z- 0 _p =0 _o (1+(1	3se : /Interpolatu > 5.3m/s u 	or z(m) = z(ft) = ed p to ~350'agl	-380.
Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack. Rel. IH = 130.0 2000.0 3000.0 3000.0 3000.0 3000.0 400.0 500.0 600.0 700.0 800.0 1000.0 1100.0 1200.0 1300.0 1400.0 1500.0 1600.0 1700.0 1700.0 1800.0 1700.0 1800.0 1700.0 1200.0 1200.0 1200.0 1200.0 1200.0 1200.0 1200.0 1200.0 1200.0 1200.0 1200.0 1200.0 1200.0 1200.0 2000.0 2000.0 2000.0 2000.0 2000.0 <	lume-averag (meters) above stack 0.000 6.10 21.34 51.82 82.30 112.78 143.26 173.74 204.22 234.70 2265.18 295.66 326.14 356.62 337.10 417.58 448.06 478.54 492.16 509.02 539.50 569.93 509.02 539.50 569.93 600.44 630.94 63	ed Vertical N Plume Radius(m) 40.665 41.153 42.372 44.810 47.248 49.687 52.125 54.564 57.002 59.440 61.879 64.317 66.756 69.194 71.632 74.071 76.509 78.947 80.037 81.330 79.474 80.337 79.474 81.330 79.474 81.330 79.474 81.330 79.474 81.327 81.327 81.327 81.327 81.327 81.327 81.327 81.327 81.327 81.327 81.327 81.327 81.327 81.327 81.327 81.557 85.55	/elocities sta Vert. Vel(m/s) 5.64 5.55 5.38 5.21 5.44 4.87 4.70 4.53 4.36 3.43 3.68 3.51 3.34 4.30 2.93 2.24 2.86 3.61 4.01 4.22 4.60 4.61 4.71 4.65 4.42 4.65 4.65 4.65	feet rting at en Plume Temp(K) 296.79 295.05 294.25 293.74 293.38 292.88 292.54 293.38 292.54 293.38 292.11 291.97 291.85 291.75 291.60 291.54	Jet Phase Jet Phase Spillane E V _{plume} =(Va), a = 0.16(z- 0 _p =0 _o (1+(1	3se : /Interpolatu > 5.3m/s u 	or z(m) = z(ft) = ed p to ~350'agl	-380.
Table of Plume Top-Hat Diameters (2a) and P Height (feet) above ground Stack. Rel. IH = 130.0 2000.0 300.0 300.0 300.0 400.0 500.0 600.0 700.0 800.0 900.0 1000.0 1100.0 1200.0 1300.0 1400.0 150.0 1600.0 1700.0 1800.0 1700.0 1800.0 1700.0 1800.0 1900.0 2000.0 2000.0 2000.0 2000.0 2000.0 2000.0 2000.0 2000.0 2000.0 2000.0 2000.0 2000.0 2000.0 2000.0 2000.0 2000.0 2000.0 2000.0	lume-averag (meters) above stack 0.000 6.10 21.34 51.82 82.30 112.78 24.30 112.78 24.30 225.18 2254.70 225.18 2254.70 225.18 2254.70 225.18 2255.66 236.71 255.66 236.71 255.65 238.71 0 417.55 509.02 509.02 539.50 569.98 600.46 650.32 509.02 539.50 569.98 600.46 651.90 559.50 569.98 600.46 651.90 559.50 569.98 600.46 651.90 559.50 569.98 600.46 651.90 559.50 569.98 600.46 651.90 559.50 569.98 600.46 651.90 559.50 569.98 600.46 651.90 559.50 569.98 600.46 651.90 559.50 569.98 600.46 651.90 559.50 569.98 600.46 651.90 559.50 569.98 600.46 651.90 559.50	ed Vertical N Plume Radius(m) 40.665 41.153 42.372 44.810 47.248 49.687 52.125 54.564 57.002 59.440 61.879 64.317 66.756 69.194 71.632 74.071 76.509 78.947 80.037 81.330 79.474 80.337 79.474 81.330 79.474 81.330 79.474 81.330 79.474 81.327 81.327 81.327 81.327 81.327 81.327 81.327 81.327 81.327 81.327 81.327 81.327 81.327 81.327 81.327 81.557 85.55	/elocities sta Vert. Vel(m/s) 5.64 5.55 5.38 5.21 5.64 4.87 4.70 4.53 4.36 3.68 3.61 3.34 2.86 3.61 4.99 4.02 3.85 3.68 3.61 4.90 4.02 3.85 3.68 3.61 4.00 4.02 2.86 3.61 4.10 4.25 4.42 4.65 4.41 4.57 4.42 4.57 4.42 4.57 4.42 4.57 4.42 4.57 4.42 4.57 4.42 4.57 4.42 4.57 4.42 4.57 4.42 4.57 4.42 4.57 4.53 4.53 4.53 4.53 4.53 4.53 4.53 4.53	feet rting at en Plume Temp(K) 296.79 295.05 294.25 293.74 293.38 292.88 292.84 292.30 292.11 291.97 291.65 291.75 291.67 291.60 291.54 291.45	Jet Phase Jet Phase Spillane E V _{plume} =(Va), a = 0.16(z- 0 _p =0 _o (1+(1	3se : /Interpolatu > 5.3m/s u 	or z(m) = z(ft) = ed p to ~350'agl	-380.



SINGLE Plume Average Vertical Velocities for	"Aviation Sa							
						ditions at V	arious Heights in the Plum	0
							Australia," Dr. K.T. Spilla	
Ambient Conditions		nom a Gas	. ar buile FOW				eutral conditions (d6/dz=0 or	
Ambient Potential Temp 8a	309 82	Kelvins	98.0				meters/feet	03 02/
Plume Exit Conditions	000.02	Ter and	00.0	· · · · · ·	Gravity g		m/s ²	
Stack Height hs	39.62	meters	130.0	feet	λ	1.11	11/5	
Stack Diameter D	78.7472		258.36		λ.	~1.0		
Stack Velocity Vexit		m/s		t/sec	76	1.0		
								Cont 2451
Volumetric Flow	27,712.29		58,719,014		πV _{ext} D ² /4			Sect.2/¶1
Stack Potential Temp 8s		Kelvins	130.10	Th.				
Initial Stack Buoyancy Flux Fo	4,709.04						ol.Flow(g/π)(1-θ _s /θ _s)	Sect.2/¶1
Plume Buoyancy Flux F	N/A	m ⁴ /s ³			λ*gVa*(1-θ	√e₀) fora,V	θ_p at plume height (see belo	(W)
Conditions at End (Top) of Jet Phase:								
Height above Stack z _{jet}	492.170	meters*	1614.7	feet*	z _{jet} = 6.250	, meters*=	meters above stack top	Sect.3/¶1
Height above Ground ze:+hs	531.790	meters	1744.7	feet				
Vertical Velocity Vet	2.845	m/s	9.33	t/sec	Vjet = 0.5Ve	exit = Vext/2		-
Plume Top-Hat Diameter 2ajet	157.494	meters	516.7	feet	2ajet = 2D		Conservation of momentum	
•								
pillane Methodology - Analytical Solutions	for Calm Con	ditions for P	lume Height	sabove Je	t Phase			
Single Plume-averaged Vertical Velocity						niven hv e	quations below:	
Plume Top-Hat Radius a		olutions in T					crease with height	Sect 2/Eq.6
				fatt			crease with neight ers*=meters above stack top	Sect 2/Eq.6
Virtual Source Height zu		meters*		feet*	0.23U[1-(8e	vos) [, mete	where $(\theta_a/\theta_s)^{1/2} = (\theta_a/\theta_s)^{1/2} =$	
Height above Ground zv +hs		meters	174.5	eet	m + 1 3			
Vertical Velocity V		olutionsinT	able Below) ² - (6.25D-zv) ²]} ^(1/3) / a	Sect.2.1(6)
Product (Va)-	217.855	m*/s			VexitD/2(θe/	0s)"*		
Solve for plume-averaged vertical velo	city at height	1,500.0			meters abo			
Gives the following Height above Stack z'	417.580	meters*	1370.0	feet*		HeightE	ntered < Top of Jet - Cann	ot Be Solved
Plume Top-Hat Diameter 2a'	#N/A	meters	#N/A	feet	2a'=2*0.16(Sect 2/Eq.6
Vertical Velocity V	#N/A	m/s	#N/A	t/sec	V={(Va)o3+	0.12Fo[(z-z)) ² -(6.25D-zv) ²]} ^(1/3) /(2a/2)	Sect 2/Eq.6
Solve for Height of CASC critical vertical	velocity Vort	5.30	m's plume-	veraged v	ertical velo	city	Critical W	< Top of Jet
Find Height above Stack Zent	And the second sec	meters	#N/A				Itaneously in both eqs. (i.e.,	and the second second second
Height above Ground zerit+hs		meters	#N/A				e cubic equation ax ³ +bx ² +cx	
nagit above oreand zerona		metero		NOT	01 1-1.0 1		and b=-(0.12Fo)/(4.330.163)=	
Interpolated Height of critical vertical verticae verticae verticae vertica	alocity in let	Dhaeer			and a		25D-zv) ² -(Va)o ³]/(4.3 ³ 0.16 ³)=	
			221.4	6 - 4	and c	F[U.12F₀(0.	230-2v) -(va) p(4.3 0.16 = http://www.1728	
Find Height above Stack Zent	67.468							
Height above Ground Zont+hs ble of Plume Top-Hat Diameters (2a) and F	107.088 Nume-averag	meters	351.3	feet	ndofjetpha		s the real solution x = z-zv = or z(m) = z(ft) =	-385.7550 -372.176
	'lume-averag (meters)	meters jed Vertical ' Plume	351.3 Velocities sta Vert.	feet arting at er			s the real solution x = z-zv= or z(m) =	-385.7550 -372.176
able of Plume Top-Hat Diameters (2a) and F Height (feet)	'lume-averag (meters)	meters jed Vertical ' Plume	351.3 Velocities sta Vert.	feet arting at er Plume Temp(K)		1 90:	s the real solution x = z-zv = or z(m) = z(ft) =	-385.7550 -372.176
able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground	'lume-averag (meters) above stack	meters ed Vertical Plume Radius(m) 39.374	351.3 Velocities sta Vert. Vel(m/s)	feet anting at er Plume Temp(K)		1 90:	s the real solution x = z-zv = or z(m) = z(ft) =	-385.7550 -372.176
able of Plume Top-Hat Diameters (2a) and f Height (feet) above ground Stack. Rel.Ht = 130.0	lume-averag (meters) above stack 0.00	meters ed Vertical V Plume Radius(m) 39.374 39.861	351.3 Velocities sta Vel Vel(m/s) 5.69	feet arting at er Plume Temp(K)	Jet Phase	a se: 'Interpolati	s the real solution x = z-zv = or z(m) = z(ft) =	-385.7550 -372.176
able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack. Rel.Ht = 130.0 150.0 200.0	lume-averag (meters) above stack 0.00 6.10 21.34	meters ed Vertical Plume Radius(m) 39.374 39.861 41.081	351.3 Velocities sta Vert. Vel(m/s) 5.69 5.65 5.57	feet arting at er Plume Temp(K)	Jet Phase	a se: 'Interpolati	s the real solution x = 2-zv = or z(m) = z(t) =	-385.7550 -372.176
able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground <i>Stack. Re.Litt</i> = 130.0 150.0 200.0 300.0	lume-averag (meters) above stack 0.00 6.10	meters ed Vertical 1 Plume Radius(m) 39.374 39.861 41.081 43.519	351.3 Velocities sta Vert. Vel(m/s) 5.69 5.65	feet arting at er Plume Temp(K)	Jet Phase	a se: 'Interpolati	s the real solution x = 2-zv = or z(m) = z(t) =	-385.7550 -372.176
able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground <i>Stack. Rel.Ht</i> = 130.0 150.0 200.0	lume-averag (meters) a bove stack 0.00 6.10 21.34 51.82	meters ed Vertical 1 Plume Radius(m) 39.374 39.861 41.081 43.519 45.957	351.3 Velocities st Vert. Vel(m's) 5.65 5.57 5.39	feet arting at er Plume Temp(K)	Jet Phase	a se: 'Interpolati	s the real solution x = 2-zv = or z(m) = z(t) =	-385.7550 -372.176
able of Plume Top-Hat Diameters (2a) and f Height (feet) above ground <i>Stack: Rel.Ht</i> = 130.0 200.0 300.0 400.0 500.0	lume-a verag (meters) a bove stack 0.00 6.10 21.34 51.82 82.30 112.78	meters ed Vertical 1 Plume Radius(m) 39.374 39.861 41.081 43.519 45.957 48.396	351.3 Velocifies st Vert. Vel(m/s) 5.65 5.57 5.39 5.21 5.04	feet arting at er Plume Temp(K)	Jet Phase	a se: 'Interpolati	s the real solution x = 2-zv = or z(m) = z(t) =	-385.7550 -372.176
able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground <i>Stack. Rel.Ht</i> = 130.0 200.0 300.0 400.0 500.0 600.0	lume-a verag (meters) a bove stack 0.00 6.10 21.34 51.82 82.30 112.78 143.26	meters ed Vertical 1 Plume Radius(m) 39.374 39.861 41.081 43.519 45.957 48.396 50.834	351.3 Velocifies st Vert. Vel(m/s) 5.65 5.57 5.39 5.21 5.04 4.86	feet arting at er Plume Temp(K)	Jet Phase	a se: 'Interpolati	s the real solution x = 2-zv = or z(m) = z(t) =	-385.7550 -372.176
able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack. Rel.Ht = 130.0 200.0 300.0 400.0 500.0 600.0 700.0	lume-a verag (meters) above stack 0.00 6.10 21.34 51.82 82.30 112.78 143.26 173.74	meters ed Vertical 1 Plume Radius(m) 39.374 39.861 41.081 43.519 45.957 48.396 50.834 53.273	351.3 Velocities st Vert. Vel(m's) 5.69 5.65 5.57 5.39 5.21 5.04 4.86 4.69	feet arting at er Plume Temp(K)	Jet Phase	a se: 'Interpolati	s the real solution x = 2-zv = or z(m) = z(t) =	-385.7550 -372.176
able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground <i>Stack: Rel.Ht</i> = 130.0 200.0 300.0 400.0 500.0 600.0 700.0 800.0	lume-averag (meters) above stack 0.00 6.10 21.34 51.82 82.30 112.78 143.26 173.74 204.22	meters red Vertical ¹ Plume Radius(m) 39.374 39.861 41.081 43.519 45.957 48.396 50.834 53.273 55.711	351.3 Velocifies sta Vert. Vel(m's) 5.65 5.57 5.39 5.21 5.04 4.86 4.69 4.51	feet arting at er Plume Temp(K)	Jet Phase	a se: 'Interpolati	s the real solution x = 2-zv = or z(m) = z(t) =	-385.7550 -372.176
able of Plume Top-Hat Diameters (Za) and F Height (feet) above ground Stack: Rel.Ht = 130.0 150.0 200.0 300.0 400.0 500.0 600.0 700.0 800.0 800.0 900.0	lume-averag (meters) above stack 0.00 6.10 21.34 51.82 82.30 112.78 143.26 173.74 204.22 234.70	meters ed Vertical 1 Plume 39,374 39,861 41,081 43,549 45,957 48,396 50,834 53,273 55,711 58,150	351.3 Velocities st Vert. Vel(m's) 5.69 5.57 5.39 5.21 5.04 4.86 4.69 4.486 4.69 4.51	feet arting at er Plume Temp(K)	Jet Phase	a se: 'Interpolati	s the real solution x = 2-zv = or z(m) = z(t) =	-385.7550 -372.176
able of Plume Top-Hat Diameters (Za) and F Height (feet) above ground Stack. Rel.Ht = 130.0 200.0 300.0 400.0 500.0 600.0 700.0 800.0 900.0 1000.0	lume-a verag (meters) a bove stack 0.00 6.10 21.34 51.82 82.30 112.78 143.26 173.74 204.22 234.70 265.18	meters ed Vertical Plume Radius(m) 39,374 39,861 41,081 43,519 45,957 48,396 50,834 53,273 55,711 58,150 60,588	351.3 Velocifies str Vert. Vel(m' 3) 5.65 5.57 5.39 5.21 5.04 4.69 4.69 4.51 4.33 4.16	feet arting at en Plume Temp(K)	Jet Phase	a se: 'Interpolati	s the real solution x = 2-zv = or z(m) = z(t) =	-385.7550 -372.176
able of Plume Top-Hat Diameters (2a) and Height (feet) above ground Stack. Rel.Ht = 130.0 200.0 300.0 400.0 500.0 600.0 700.0 800.0 900.0 1100.0	lume-a verag (meters) a bove stack 0.000 6.10 21.34 51.82 82.30 112.73 143.26 173.74 204.22 234.70 265.16 295.66	meters red Vertical Plume 33,374 33,861 41,081 45,967 48,396 50,834 55,273 55,711 58,150 60,558 63,027	351.3 Velociti es st Vert. Vel(m3) 5.65 5.39 5.21 5.04 4.86 4.69 4.51 4.33 4.61 3.98	feet arting at er Plume Temp(K)	Jet Phase	a se: 'Interpolati	s the real solution x = 2-zv = or z(m) = z(t) =	-385.7550 -372.176
able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack: Rel.Ht = 130.0 200.0 300.0 400.0 500.0 600.0 700.0 800.0 900.0 1100.0 1100.0	lume a verag (meters) above stack 0.00 6.10 21.34 51.82 82.30 112.78 143.26 173.74 204.22 234.70 265.18 225.65 326.14	meters Plume Radius(m) 39,374 39,384 41,081 41,081 43,519 45,957 48,396 50,834 53,273 55,711 58,150 60,588 63,027 65,465	351.3 Velocifie s sta Vert. Vel(m/s) 6.65 6.57 6.53 5.21 5.04 4.86 4.65 4.65 4.51 4.33 4.33 4.33 4.33 4.33 4.33 4.33 4.3	feet arting at er Plume Temp(K)	Jet Phase	a se: 'Interpolati	s the real solution x = 2-zv = or z(m) = z(t) =	-385.7550 -372.176
able of Plume Top-Hat Diameters (Za) and F Height (feet) above ground Stack Rel.Ht = 130.0 200.0 300.0 400.0 500.0 600.0 700.0 800.0 900.0 1000.0 1100.0 1200.0 1300.0	lume a verag (meters) a bove stack 0.00 6.10 21.34 51.82 82.30 1112.78 143.26 173.74 204.22 234.70 265.18 295.66 236.64 356.62	meters ed Vertical Plume Radius(m) 39,374 39,861 41,061 43,519 45,967 48,396 50,834 55,2711 58,150 60,588 63,027 65,465 67,903	351.3 Velocifi es sta Vert. Vert. Vert. 5.69 5.57 5.39 5.21 5.04 4.66 4.66 4.66 4.66 4.65 4.45 3.98 3.80 3.80 3.63	feet arting at er Plume Temp(K)	Jet Phase	a se: 'Interpolati	s the real solution x = 2-zv = or z(m) = z(t) =	-385.7550 -372.176
able of Plume Top-Hat Diameters (Za) and F Height (feet) above ground Stack: Rel.H = 130.0 200.0 300.0 600.0 600.0 600.0 600.0 600.0 1000.0 1100.0 1100.0 1300.0 1400.0	lume-averag (meters) a bove stack 0.00 6.10 21.34 51.82 82.30 1112.78 143.26 173.74 204.22 2234.70 265.18 295.66 326.14 356.62 387.10	meters Plume Radius(m) 39,374 39,374 39,374 41,061 41,061 43,549 50,834 53,273 55,711 58,150 60,588 63,027 65,465 67,903 70,342	351.3 Velocifies sk Vert. Vel(m/s) 6.65 6.57 5.39 5.21 5.04 4.66 4.66 4.66 4.65 4.33 4.16 3.380 3.80 3.80 3.80 3.345	feet arting at er Plume Temp(K)	Jet Phase	a se: 'Interpolati	s the real solution x = 2-zv = or z(m) = z(t) =	-385.7550 -372.176
able of Plume Top-Hat Diameters (Za) and F Height (feet) above ground Stack Rel.Ht = 130.0 200.0 300.0 400.0 500.0 600.0 700.0 800.0 900.0 1000.0 1100.0 1200.0 1300.0	lume a verag (meters) a bove stack 0.00 6.10 21.34 51.82 82.30 1112.78 143.26 173.74 204.22 234.70 265.18 295.66 236.64 356.62	meters Plume Radius(m) 39,374 39,374 39,374 41,061 41,061 43,549 50,834 53,273 55,711 58,150 60,588 63,027 65,465 67,903 70,342	351.3 Velocifies sk Vert. Vel(m/s) 6.65 6.57 5.39 5.21 5.04 4.66 4.66 4.66 4.65 4.33 4.16 3.380 3.80 3.80 3.80 3.345	feet arting at er Plume Temp(K)	Jet Phase	a se: 'Interpolati	s the real solution x = 2-zv = or z(m) = z(t) =	-385.7550 -372.176
able of Plume Top-Hat Diameters (Za) and F Height (feet) above ground Stack: Re.Ir.H = 130.0 200.0 300.0 600.0 600.0 600.0 600.0 600.0 1000.0 1100.0 1100.0 1200.0 1300.0 1400.0	lume-averag (meters) a bove stack 0.00 6.10 21.34 51.82 82.30 1112.78 143.26 173.74 204.22 2234.70 265.18 295.66 326.14 356.62 387.10	meters Plume Radius(m) 39,374 39,374 41,061 41,061 43,519 45,957 48,396 50,834 53,273 55,711 58,150 60,588 63,027 65,465 67,903 70,342 72,780	351.3 Velocifi es sta Vert. Vel(m' s) 5.69 5.57 5.39 5.21 5.04 4.69 4.69 4.469 4.469 4.469 4.451 4.33 4.61 3.398 3.300 3.345 3.28	feet arting at er Plume Temp(K)	Jet Phase	a se: 'Interpolati	s the real solution x = 2-zv = or z(m) = z(t) =	-385.7550 -372.176
able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack. Re.LHt = 130.0 200.0 200.0 400.0 500.0 600.0 600.0 700.0 800.0 1000.0 1100.0 1100.0 1300.0 1400.0 1300.0	lume-a verag (meters) above stack 6.00 6.10 6.10 6.12 82.30 112.78 82.30 112.78 143.26 113.74 204.22 234.70 265.18 295.66 336.14 356.62 387.10 417.58	meters Plume Radius(m) 39,374 39,374 39,3861 41,081 43,5957 48,396 53,273 55,711 58,150 63,027 65,465 67,903 70,342 72,780 75,219	351.3 Velocifie s sta Vert. Vel(m/s) 6.65 6.57 6.39 5.21 5.04 4.86 4.69 4.51 4.33 4.16 3.989 3.380 3.380 3.383 3.45 3.223 3.223 3.223 3.10	ibet arting at er Plume Temp(K)	Jet Phase	a se: 'Interpolati	s the real solution x = 2-zv = or z(m) = z(t) =	-385.7550 -372.176
able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack: Rel.Ht = 130.0 200.0 300.0 400.0 500.0 600.0 700.0 800.0 900.0 1100.0 1100.0 1100.0 1100.0 1100.0 1100.0 1100.0 1100.0 1100.0 1100.0 1100.0	lume a verag (meters) above stack 0.00 6.10 21.34 51.82 82.30 112.78 143.26 173.74 204.22 224.70 265.18 326.54 326.62 336.62 337.10 447.58	meters red Vertical Plume Radius(m) 39,374 39,861 41,061 43,519 45,967 48,396 50,834 55,711 58,150 60,588 60,588 60,588 60,588 60,588 60,588 60,588 67,903 70,342 72,780 75,219 77,667	351.3 Velocifie s sta Vert. Vel(m/s) 6.65 6.57 6.53 5.21 5.04 4.86 4.65 4.51 4.33 4.16 3.989 3.80 3.380 3.380 3.383 3.45 3.222 3.223 3.10	bet arting at er Plume Temp(k)	Jet Phase	a se: 'Interpolati	s the real solution x = 2-zv = or z(m) = z(t) =	-385.7550 -372.176
able of Plume Top-Hat Diameters (Za) and F Height (feet) above ground Stack ReLHt = 130.0 150.0 200.0 300.0 400.0 500.0 600.0 700.0 800.0 1000.0 1000.0 1100.0 1200.0 1300.0 1500	lume a verag (meters) a bove stack 0.00 6.10 21.34 51.82 82.30 1112.78 143.26 1473.74 245.22 234.70 265.18 295.66 236.62 337.10 417.58 448.66 478.54	meters red Vertical Plume Radius(m) 39,374 39,374 41,061 41,061 43,549 45,957 48,396 50,834 55,273 55,711 58,150 60,588 63,027 65,465 67,903 70,342 72,780 70,342 72,780 75,219 77,867 78,747	351.3 Velocifies sk Vert. Vel(m's) 6.65 6.57 5.39 5.21 5.04 4.66 4.66 4.66 4.66 4.65 4.33 4.66 3.80 3.80 3.80 3.80 3.32 2.22 2.85	feet arting at er Plume Temp(K)	Jet Phase	a se: 1 nterpola ti > 5.3m's u	s the real solution x = 2-zv = or z(m) = z(t) =	-385.7550 -372.176
able of Plume Top-Hat Diameters (Za) and F Height (feet) above ground Stack: Rel.Ht = 130.0 500.0 300.0 600.	lume a verag (meters) a bove state 6.10 21.34 51.82 82.30 112.78 143.26 173.74 204.22 2234.70 225.18 295.66 326.14 336.61 336.61 336.14 336.14 336.14 348.06 478.54 492.16	meters red Vertical Plume Radius(m) 39,374 39,374 43,967 43,967 43,967 45,957 48,396 50,834 53,273 55,711 58,150 60,588 63,027 65,465 67,903 70,342 72,780 75,219 77,657 78,747 79,158	351.3 Velocifies sk Vert. Vel(m's) 6.65 6.57 5.39 5.21 5.04 4.66 4.66 4.66 4.66 4.65 4.33 4.66 3.80 3.80 3.80 3.80 3.32 2.22 2.85	bet arting at er Plume Temp(K) 315.51	Jet Phase Jet Phase Spillane E	a se: 1 nterpola ti > 5.3m's u quation s	s the real solution x = 2-zv = or z(m) = z(t) =	-385.7550 -372.176
able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack. Rel.Ht = 130.0 200.0 400.0 500.0 600.0 700.0 800.0 900.0 1000.0 1100.0 1100.0 1200.0 1300.0 1400.0 1500.0 1500.0 1700.0 1700.0 1700.0 1707.7 1800.0	lume a verag (meters) above stack 0.00 6.10 21.34 51.82 82.30 112.78 143.26 173.74 204.22 224.70 265.18 326.14 326.62 337.10 447.85 448.06 447.85 448.06 508.32 509.02	meters Plume Radius(m) 39.374 39.374 39.3861 41.081 43.5957 48.396 53.273 55.711 58.150 63.027 65.465 67.903 70.342 72.780 75.219 77.657 78.747 79.158 79.271	351.3 Velocifie s sta Vert. Vel(m/s) 5.65 5.65 5.65 5.64 4.66 4.66 4.66 4.66	bet arting at er Plume Temp(K) 315.51 315.47	Jet Phase Jet Phase Spillane E	a se: Interpolations > 5.3m's u quations ^{240.12F₈(z-z,}	s the real solution x = 2-2v= or z(m) = z(ft) = ed p to ~350/agi	-385.7550 -372.176
able of Plume Top-Hat Diameters (Za) and F Height (feet) above ground Stack ReLINE = 130.0 150.0 200.0 300.0 400.0 500.0 600.0 700.0 800.0 1000.0 1000.0 1100.0 1100.0 1200.0 1300.0 1500.0 1500.0 1500.0 1700.0 150	lume a verag (meters) a bove stack 0.00 6.10 21.34 51.82 82.30 1112.78 143.26 1473.74 245.18 295.66 226.14 356.62 336.14 356.62 337.10 417.58 448.06 478.54 492.16 509.02 539.50	meters red Vertical Plume Radius(m) 39,374 39,861 41,061 43,519 45,957 48,396 50,834 55,711 58,150 60,588 63,027 65,465 67,903 70,342 77,657 78,747 79,158 79,2211 84,147	351.3 Velocifie se sta Vert, Vert, 5.65 5.67 5.33 5.21 5.04 4.86 4.69 4.51 4.33 4.16 3.380 3.380 3.383 3.45 3.28 3.300 2.92 2.85 3.383 3.393 3.393	bet arting at er Plume Temp(K) 315.51 315.47 314.12	Jet Phase Jet Phase Spillane E V _{pum} ={(va), a = 0.16(z-	a se: Interpola to > 5.3m/s u quations +0.12F _s (z-z, z,)	s the real solution x = z-zv= or z(m) = z(ft) = ed p to ~350*ag1	-385.7550 -372.176
able of Plume Top-Hat Diameters (Za) and F Height (feet) above ground Stack: Rel.Ht = 130.0 150.0 200.0 300.0 300.0 600.0 600.0 600.0 600.0 600.0 600.0 600.0 1000.0 1000.0 1100.0 1100.0 1200.0 1300.0 1400.0 1500.	lume averag (meters) above states above stat	meters red Vertical Plume Radius(m) 39,374 39,374 41,081 41,081 43,519 45,957 48,396 50,834 53,273 55,711 56,855 63,027 65,465 63,027 70,342 72,780 70,342 74,840 74,840 74,840 75,711 76,840 76,840 76,840 76,840 76,840 76,840 76,940 76,840 76,940 77,840 76,940 77,840 79,188 79,271 79,188 79,271 79,188 79,271 79,188 79,271 79,188 79,271 79,188 70,271 70,342	351.3 Velocifi es sk Vert. Vel(m's) 5.65 5.65 5.39 5.21 5.04 4.66 4.69 4.469 4.51 4.66 3.80 3.80 3.80 3.80 3.80 3.80 3.80 3.80	bet rting at er Plume Temp(K) 315.51 315.47 314.12 313.37	Jet Phase Jet Phase Spillane E $V_{\rho u \sigma} = (V \sigma)_{\sigma}$ $\theta_{\rho} = \theta_{\sigma} (1+(1-1))$	a se: Interpola to > 5.3m/s u quations +0.12F _s (z-z, z,)	s the real solution x = 2-2v= or z(m) = z(ft) = ed p to ~350/agi	-385.7550 -372.176
able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack. Rel.Ht = 130.0 200.0 200.0 400.0 500.0 600.0 700.0 800.0 900.0 1000.0 1100.0 1100.0 1200.0 1100.0 1200.0 1100.0 1200.0 1100.0 1200.0 1100.0 12	lume a verag (meters) above stack 0.00 6.10 6.10 6.12 82.30 112.78 82.30 112.78 143.26 173.74 204.22 224.70 265.18 2265.18 236.62 337.10 417.58 448.06 478.54 48.06 478.54 508.32 509.02 539.50 559.58 600.46	meters red Vertical Plume Radius(m) 39,374 39,374 41,061 43,519 45,957 48,396 50,834 53,273 55,711 58,150 60,588 63,027 65,465 67,903 70,342 72,780 75,219 77,657 79,158 79,271 84,147 79,158 79,271 84,147 89,024 93,901	351.3 Velocifi es sta Vert. Vel(m/ s) 5.69 5.57 5.39 5.21 5.04 4.69 4.69 4.69 4.469 4.469 4.469 4.469 4.451 3.300 3.345 3.300 3.345 3.328 3.310 2.92 2.265 3.338 3.40 3.97 4.229 4.50	bet rting at er Plume Temp(K) 315.51 315.47 314.12 313.37 312.86	Jet Phase Jet Phase Spillane E $V_{pur}=\{(Va)_{n}$ $a = 0.16(z-6_{n}=0s)(1+(1-2))$	a se: Interpola to > 5.3m/s u quations +0.12F _s (z-z, z,)	s the real solution x = z-zv= or z(m) = z(ft) = ed p to ~350*ag1	-385.7550 -372.176
able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack. Rel.Ht = 130.0 200.0 200.0 400.0 500.0 600.0 700.0 800.0 900.0 1000.0 1000.0 1100.0 1200.0 1300.0 1400.0 1500.0 1500.0 1500.0 1100.0 1200.0 1500.0 1700.0 1700.0 1700.0 1707.0 1797.7 1800.0 1900.0 20	lume a verag (meters) above stack 0.00 6.10 21.34 51.82 82.30 112.78 143.26 173.74 204.22 224.70 265.18 326.14 326.62 337.10 447.85 448.06 447.85 492.16 509.02 539.50 569.98 600.46 630.94	meters Plume Radius(m) 39,374 39,374 39,374 43,3619 45,967 48,396 50,834 53,273 55,711 58,150 60,588 63,027 65,465 67,903 70,342 72,780 75,219 77,657 78,747 79,158 79,9271 84,147 89,024 93,901 98,778	351.3 Velocifie s sk Vert. Vel(m/s) 5.65 5.67 5.39 5.21 5.04 4.86 4.65 4.55 4.455 4.33 4.16 3.380 3.380 3.380 3.380 3.380 3.383 3.45 3.225 3.383 3.40 3.380 3.340 3.397 4.29 4.29 4.55 3.385 3.24 5.25 5.25 5.25 5.25 5.25 5.25 5.25 5	bet rting at er Plume Temp(K) 315.51 315.47 314.12 313.37 312.49 312.49	Jet Pha se Jet Pha se Jet Pha se $V_{pum} = \{(V_a), a = 0.16(z - 6_p = 8_n(1+(1-2)))\}$	a se: Interpola to > 5.3m/s u quations +0.12F _s (z-z, z,)	s the real solution x = z-zv= or z(m) = z(ft) = ed p to ~350*ag1	-385.7550 -372.176
able of Plume Top-Hat Diameters (Za) and F Height (feet) above ground Stack ReLift = 130.0 150.0 200.0 400.0 500.0 600.0 700.0 800.0 700.0 800.0 1000.0 1000.0 1000.0 1100.0 1200.0 1300.0 1400.0 1500.0 1500.0 170p of jet = 1744.7 1797.7 1800.0 1900.0 200.	lume a verag (meters) a bove stack 0.00 6.10 21.34 51.82 82.30 1112.78 143.25 173.74 224.20 225.18 225.18 225.66 236.14 356.62 337.10 417.58 448.06 4478.54 492.16 509.02 539.50 539.50 569.98 600.46 630.44	meters red Vertical Plume Radius(m) 39,374 39,861 41,691 41,5957 48,396 50,834 55,711 58,150 60,588 63,027 65,465 67,903 70,342 72,780 75,219 77,657 78,747 79,158 79,221 84,147 89,024 98,378 108,531 108,551 108,551 108,551 108,551 108,551 108,555 10	351.3 Velocifie se sta Vert. Vel(m/s) 6.65 6.57 5.39 5.21 5.04 4.86 4.69 4.51 4.33 4.451 4.33 4.51 4.33 3.80 3.380 3.380 3.383 3.45 3.228 3.300 2.92 2.85 3.383 3.40 3.383 3.45 3.328 3.300 2.92 2.85 3.383 3.44 4.51 4.51 4.51 4.51 4.51 4.51 4.52 4.51 4.52 5.52 5.52 5.52 5.52 5.52 5.52 5.52	bet arting at er Plume Temp(K) 315.51 315.47 314.12 313.37 312.86 312.49 311.96	Jet Phase Jet Phase Spillane E V _{pum} ={(Va), a = 0.16(z- 0p=0s(1+(1-	a se: Interpola to > 5.3m/s u quations +0.12F _s (z-z, z,)	s the real solution x = z-zv= or z(m) = z(ft) = ed p to ~350*ag1	-385.7550 -372.176
able of Plume Top-Hat Diameters (Za) and F Height (feet) above ground Stack: Rel.Ht = 130.0 500.0 300.0 100.	lume a verag (meters) a bove stack 0.00 6.10 21.34 51.82 82.30 1112.78 1143.26 1173.74 204.22 2234.70 2255.18 295.66 236.14 336.62 337.10 417.58 438.66 236.14 356.62 337.10 417.58 509.02 509.02 509.92 509.92 509.93 600.46 60.94	meters red Vertical Plume Radius(m) 39,374 43,987 44,081 43,519 45,957 48,396 50,834 53,273 55,711 58,150 60,588 63,027 65,455 63,027 76,5455 79,033 70,342 72,780 75,219 77,657 78,747 79,158 79,271 84,147 89,024 93,901 94,778 108,578 118,285	351.3 Velocifies sk Vert. Vel(m's) 5.65 5.57 5.39 5.21 5.04 4.66 4.69 4.469 4.51 4.63 3.60 3.60 3.60 3.60 3.60 3.60 3.60 3	bet rting at er Plume Temp(K) 315.51 315.47 314.12 313.37 312.49 311.60 311.60	Jet Phase Jet Phase Spillane E $V_{purs}=\{(Vs),$ a = 0.16(2, $\theta_p=\theta_s(1+(1,$	a se: Interpola to > 5.3m's u quations ² +0.12F ₀ (z-z, z,) (θ ₂ /θ ₂))*(V ₂)	s the real solution x = z-zv= or z(m) = z(ft) = ed p to ~350*ag1	-385.7550 -372.176
able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack ReLH = 130.0 200.0 200.0 400.0 500.0 600.0 600.0 700.0 800.0 900.0 1000.0 1000.0 1100.0 1200.0 1300.0 1400.0 1500.0 1400.0 1500.0 1700.0 1900.0 1900.0 1900.0 2000.0	lume a verag (meters) above stack 0.00 6.10 6.10 6.12 82.30 112.78 82.30 112.78 143.26 173.74 204.22 224.70 2265.18 225.66 326.61 336.71 336.71 336.71 539.50 509.92 539.50 559.93 600.46 630.94 630.94 630.94 631.82	meters Plume Radius(m) 39,374 39,374 39,374 43,967 43,967 45,957 48,396 50,834 53,273 55,711 58,150 60,528 63,027 65,465 67,903 77,657 72,780 77,2780 77,2780 77,2778 79,158 79,271 84,147 79,158 79,271 84,147 79,158 79,271 84,147 79,158 79,271 18,203 90,778 118,205 118,205 128,039	351.3 Velocifi es sta Vert. Vel(m/s) 5.69 5.57 5.39 5.21 5.04 4.66 4.69 4.469 4.469 4.469 4.451 3.306 3.300 3.345 3.328 3.301 3.455 3.282 3.302 3.455 3.383 3.444 4.50 4.50 4.50 4.50 4.50 4.50 4.50	bet rting at er Plume Temp(K) 315.51 315.47 314.12 313.37 312.86 312.49 311.96 311.96 311.93	Jet Pha se Jet Pha se Σpillane E V _{pum} ={(Va), a = 0.16(z- θ ₀ =θ ₀ (1+(1- Max<5.3 n	a se: Interpola to > 5.3m's u quations ² +0.12F ₀ (z-z, z,) (θ ₂ /θ ₂))*(V ₂)	s the real solution x = z-zv= or z(m) = z(ft) = ed p to ~350*ag1	-385.7550 -372.176
able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack Rel.H = 130.0 500.0 000.00	lume a verag (meters) above stack 0.00 6.10 21.34 51.82 82.30 112.78 143.26 173.74 204.22 224.70 265.18 326.14 326.54 326.14 356.62 337.10 447.85 448.06 447.85 492.16 509.02 539.50 569.98 600.46 630.94 630.94 631.92 863.94 863	meters red Vertical Plume Radius(m) 39,374 39,374 39,3861 41,0819 45,967 48,396 53,273 55,711 58,150 60,588 63,027 65,465 67,903 70,342 72,780 75,219 77,78,747 79,158 79,271 84,147 89,024 93,901 98,778 108,531 118,285 128,009 137,792	351.3 Velocifie s sk Vert. Vel(m/s) 5.65 5.67 5.39 5.21 5.04 4.86 4.65 4.65 4.65 4.51 4.16 3.989 3.80 3.80 3.80 3.83 3.45 3.22 3.38 3.340 3.340 3.32 2.285 3.38 3.340 3.340 3.397 4.29 4.29 4.55 3.38 3.40 3.40 3.40 3.40 3.42 3.38 3.40 3.42 3.42 3.42 3.42 3.42 3.42 3.42 3.42	bet arting at er Plume Temp(K) 315.51 315.47 314.42 313.37 312.49 311.96 311.33 311.60 311.33 311.19	Jet Pha se Jet Pha se Jet Pha se V _{pum} =[(Va), a = 0.16(z- β _p =θ ₀ (1+(1- Max<5.3 n	a se: Interpola to > 5.3m's u quations ² +0.12F ₀ (z-z, z,) (θ ₂ /θ ₂))*(V ₂)	s the real solution x = z-zv= or z(m) = z(ft) = ed p to ~350*ag1	-385.7550 -372.176
able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack Rei.Ht = 130.0 200.0 200.0 400.0 500.0 600.0 600.0 600.0 700.0 800.0 900.0 1000.0 1000.0 1000.0 1100.0 1200.	lume a verag (meters) above stack 0.00 6.10 6.10 6.12 82.30 112.78 82.30 112.78 143.26 173.74 204.22 224.70 2265.18 225.66 326.61 336.71 336.71 336.71 539.50 509.92 539.50 559.93 600.46 630.94 630.94 630.94 631.82	meters red Vertical Plume Radius(m) 39,374 39,374 39,3861 41,0819 45,967 48,396 53,273 55,711 58,150 60,588 63,027 65,465 67,903 70,342 72,780 75,219 77,78,747 79,158 79,271 84,147 89,024 93,901 98,778 108,531 118,285 128,009 137,792	351.3 Velocifie s sk Vert. Vel(m/s) 5.65 5.67 5.39 5.21 5.04 4.86 4.65 4.65 4.65 4.51 4.16 3.989 3.80 3.80 3.80 3.83 3.45 3.22 3.38 3.340 3.340 3.32 2.285 3.38 3.340 3.340 3.397 4.29 4.29 4.55 3.38 3.40 3.40 3.40 3.40 3.42 3.38 3.40 3.42 3.42 3.42 3.42 3.42 3.42 3.42 3.42	bet arting at er Plume Temp(K) 315.51 315.47 314.42 313.37 312.49 311.96 311.33 311.60 311.33 311.19	Jet Pha se Jet Pha se Jet Pha se V _{pum} =[(Va), a = 0.16(z- β _p =θ ₀ (1+(1- Max<5.3 n	a se: Interpola to > 5.3m's u quations ² +0.12F ₀ (z-z, z,) (θ ₂ /θ ₂))*(V ₂)	s the real solution x = z-zv= or z(m) = z(ft) = ed p to ~350*ag1	-385.7550 -372.176
fable of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack Rel.H = 130.0 2000.0 2000.0 2000.0 400.0 500.0 600.0 600.0 600.0 700.0 600.0 700.0 800.0 900.0 1000.0	lume a verag (meters) above stack 0.00 6.10 21.34 51.82 82.30 112.78 143.26 173.74 204.22 224.70 265.18 326.14 326.54 326.14 356.62 337.10 447.85 448.06 447.85 492.16 509.02 539.50 569.98 600.46 630.94 630.94 631.92 863.94 863	meters red Vertical Plume Radius(m) 39,374 39,861 41,691 43,5957 48,396 50,834 53,273 55,711 58,150 60,588 63,027 65,465 67,903 70,342 72,780 75,219 77,657 78,747 79,158 108,531 118,265 108,531 118,265 112,2039 123,792 147,546	351.3 Velocifies sta Vert. Vel(m/s) 5.69 5.57 5.39 5.21 5.04 4.86 4.69 4.51 4.33 4.16 3.989 3.380 3.380 3.380 3.380 3.383 3.45 3.282 3.380 3.383 3.45 3.282 3.380 3.397 4.50 4.66 4.59 4.50 4.66 4.69 4.66 4.69 4.66 4.69 4.60 4.66 4.69 4.60 4.60 4.60 4.60 4.60 4.60 4.60 4.60	bet arting at er Plume Temp(K) 315.51 315.47 314.12 313.37 312.86 312.49 311.96 311.33 311.33 311.33 311.33	Jet Phase Jet Phase Vpum={(va) a = 0.16(z- 6p=0s(1+(1- Max<5.3 n	a se: Interpola to > 5.3m's u quations ² +0.12F ₀ (z-z, z,) (θ ₂ /θ ₂))*(V ₂)	s the real solution x = z-zv= or z(m) = z(ft) = ed p to ~350*ag1	-385.7550 -372.176
Table of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack Rel.H 150.0 200.0 200.0 300.0 400.0 500.0 600.0 600.0 700.0 600.0 700.0 800.0 900.0 1000.0 1000.0 1000.0 1000.0 1000.0 1000.0 1000.0 1000.0 1000.0 1000.0 1000.0 1000.0 1000.0 1000.0 1000.0 1000.0 1000.0 1000.0 2000.0 2000.0 2000.0 2000.0 2000.0 2000.0 2000.0 2000.0 2000.0 2000.0 2000.0 200	lume a verag (meters) above stack 0.00 6.10 21.34 51.82 82.30 1112.78 143.25 173.74 224.20 224.27 234.70 265.18 225.66 236.14 356.62 337.10 417.58 448.06 4478.54 492.16 509.02 539.50 559.98 600.46 630.44 630.44 631.82 639.57	meters red Vertical Plume Radius(m) 39,374 39,374 41,061 41,061 43,519 45,957 48,396 50,834 53,273 55,711 58,150 60,588 63,027 65,465 63,027 76,5455 79,033 77,327 79,158 79,271 84,147 89,024 93,901 93,901 93,901 118,285 128,039 137,792 147,546 157,299 147,546 157,299 147,546 157,299 147,546 157,299 147,546 157,299 147,546 157,299 147,546 157,299 147,546 157,299 147,546 157,299 147,546 157,299 147,546 157,299 147,546 157,299 147,546 157,299 147,546 157,299 147,546 157,299 147,546 157,299 147,546 157,299 147,546 157,299 147,545 147,5	351.3 Velocifies sta Vert. Vel(m/s) 5.69 5.57 5.39 5.21 5.04 4.86 4.69 4.51 4.33 4.16 3.989 3.380 3.380 3.380 3.380 3.383 3.45 3.282 3.380 3.383 3.45 3.282 3.380 3.397 4.50 4.66 4.59 4.50 4.66 4.69 4.66 4.69 4.66 4.69 4.66 4.69 4.66 4.69 4.66 4.69 4.66 4.69 4.66 4.69 4.60 4.60 4.60 4.60 4.60 4.60 4.60 4.60	bet rting at er Plume Temp(K) 315.51 315.47 314.12 313.37 312.49 311.60 311.33 311.13 311.13 310.84	Jet Pha se Jet Pha se V _{ρν,π} ={(Va), a = 0.16(2. θ _p =θ ₃ (1+(1. Max<5.3 n	a se: Interpola to > 5.3m's u quations ² +0.12F ₀ (z-z, z,) (θ ₂ /θ ₂))*(V ₂)	s the real solution x = z-zv= or z(m) = z(ft) = ed p to ~350*ag1	-385.7550 -372.176
iable of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack Rel.Ht = 130.0 2000.0 2000.0 400.0 500.0 600.0 1000.0 1100.0 1200.0 1700.0 1700.0 1700.0 1700.0 1700.0 1700.0 1700.0 1700.0 2000.0 2000.0 2000.0 2000.0 2000.0 2000.	lume a verag (meters) a bove stack 0.00 6.10 21.34 51.82 82.30 1112.78 143.26 173.74 204.22 234.70 265.18 295.66 236.14 356.62 337.10 417.58 448.06 478.54 422.16 509.02 539.50 569.98 600.46 60.94 60	meters red Vertical Plume Radius(m) 39,374 39,374 43,967 44,967 45,967 45,967 46,967	351.3 Velocifies sk Vert. Vel(m's) 5.65 5.65 5.65 5.39 5.21 5.04 4.68 4.69 4.69 4.69 4.51 4.68 3.98 3.60 3.63 3.63 3.63 3.44 5.328 3.34 4.64 4.59 4.29 4.29 4.50 4.64 4.87 4.69 4.87 4.87 4.87 4.87 4.87 4.87 4.87 4.87	bet arting at er Plume Temp(K) 315.51 315.47 314.12 313.31 312.86 312.49 311.96 311.96 311.33 311.13 310.97 310.97 310.73	Jet Phase Jet Phase V _{pum} ={(V3), a = 0.16(z- 0=8=(1+(1- Max<5.3 n	a se: Interpola to > 5.3m's u quations ² +0.12F ₀ (z-z, z,) (θ ₂ /θ ₂))*(V ₂)	s the real solution x = z-zv= or z(m) = z(ft) = ed p to ~350*ag1	-385.7550 -372.176
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able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack Rel.Ht = 130.0 200.0 400.0 500.0 600.0 700.0 800.0 900.0 10	lume a verag (meters) above stack 0.00 6.10 21.34 51.82 82.30 1112.78 143.25 173.74 204.22 224.70 2265.18 225.66 2265.18 326.62 337.10 417.58 448.06 4478.54 492.16 509.02 539.50 559.93 600.46 630.44 691.90 752.88 813.82 837.73 935.74 996.70 11057.66	meters Plume Radius(m) 39.374 39.3861 41.081 43.5499 45.957 48.396 50.834 53.273 55.711 58.150 60.588 63.027 65.465 60.588 63.027 75.219 77.857 79.158 79.271 79.158 79.271 84.147 89.024 93.901 98.778 108.551 118.285 128.039 137.792 147.546 157.299 167.053 176.8570 188.550	351.3 Velocifies sk Vert. Vel(m's) 5.65 5.57 5.39 5.21 5.04 4.66 4.69 4.451 4.33 4.16 3.380 3.80 3.380 3.345 3.22 2.85 3.38 3.345 3.32 3.340 3.340 3.340 3.340 3.40 3.40 3.40	bet arting at err Plume Temp(K) 315.51 315.47 314.12 313.37 312.66 311.96 311.33 311.33 311.33 311.33 311.44 311.35 311.64 311.35 311.64 311.35 311.64 311.55 311.64 311.55 311.65 31	Jet Phase Jet Phase V _{pum} ={(Va), a = 0.16(z- 0p=0*(1+(1- Max<5.3 n	a se: Interpola to > 5.3m's u quations ² +0.12F ₀ (z-z, z,) (θ ₂ /θ ₂))*(V ₂)	s the real solution x = z-zv= or z(m) = z(ft) = ed p to ~350*ag1	-385.7550 -372.176
iable of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack Rel.Ht = 130.0 2000.0 2000.0 400.0 500.0 600.0 600.0 700.0 800.0 600.0 700.0 800.0 900.0 1000.0 1100.0 1200.0 1300.0 1400.0 1500.0 1600.0 1700.0 1700.0 1700.0 1200.0 1200.0 1200.0 1200.0 1200.0 1200.0 200.0 200.0 200.0 200.0 200.0 200.0 200.0 200.0 200.0 200.0 200.0 200.0 200.0 200.0 200.0	Jume a verag (meters) a bove stack 0.00 6.10 21.34 51.82 82.30 112.78 112.78 1143.26 1234 204.22 234.70 225.56 326.11 235.66.62 337.10 417.53 448.06 492.65 509.02 539.50 509.32 600.46 630.94 613.82 674.78 995.74 <tr< td=""><td>meters Plume Radius(m) 39,374 39,374 39,374 43,967 44,061 43,519 45,957 48,396 50,834 53,273 55,711 58,150 60,528 63,027 65,465 67,903 70,342 72,780 75,219 77,657 78,747 79,158 79,271 78,027 79,158 79,271 78,027 79,158 79,271 78,027 79,158 79,271 78,027 79,158 79,271 78,027 79,158 79,271 78,027 79,158 79,271 78,027 79,158 79,271 78,027 79,158 79,271 78,027 71,158 79,271 78,027 79,158 79,271 78,027 71,158 79,271 78,027 71,158 79,271 78,027 79,158 79,271 78,027 79,158 79,271 78,027 79,158 79,271 78,027 79,158 79,271 79,158 79,271 78,027 79,158 79,271 78,027 79,158 79,271 78,027 79,158 79,271 78,027 79,158 79,271 78,027 79,158 79,271 78,027 79,158 79,271 79,158 79,271 79,158 79,271 79,158 79,271 79,158 79,271 79,158 79,271 79,158 79,271 79,158 79,271 79,158 79,271 79,158 79,271 79,158 79,271 79,158 79,271 79,158 79,271 79,158 79,271 79,158 79,271 78,007 79,158 79,271 78,007 78,007 78,007 79,158 79,271 78,007 78,0</td><td>351.3 Velocifi es sk Vert. Vel(m' s) 5.65 5.57 5.39 5.21 5.04 4.66 4.69 4.469 4.469 4.469 3.80 3.80 3.80 3.80 3.80 3.80 3.80 3.80</td><td>bet rting at er Plume Temp(K) 315.51 315.47 314.12 313.37 312.49 311.96 311.60 311.33 311.13 310.47 310.64 310.73 310.64 310.73 310.64 310.51 310.64 310.73 310.64 310.75 310.64 310.51 310.64 310.55 310.64 310.75 310.64 310.75 310.64 310.75 310.64 310.75 310.64 310.75 310.64 310.75 310.64 310.75 310.64 310.75 310.64 310.75 310.64 310.75 310.64 310.75 310.64 310.75 310.64 310.75 310.64 310.75 310.64 310.75 310.64 310.75 310.64 310.75 310.64 310.64 310.75 310.64 310.55 310.55 310.64 310.55 310.55 310.64 310.55 310.55 310.64 310.55 310.</td><td>Jet Pha se Jet Pha se V_{ρυτ}=((Va), a = 0.16(2. θ_p=θ₂(1+(1. Max<5.3 n</td><td>a se: Interpola to > 5.3m's u quations ²+0.12F₀(z-z, z,) (θ₂/θ₂))*(V₂)</td><td>s the real solution x = z-zv= or z(m) = z(ft) = ed p to ~350*ag1</td><td>-385.7550 -372.176</td></tr<>	meters Plume Radius(m) 39,374 39,374 39,374 43,967 44,061 43,519 45,957 48,396 50,834 53,273 55,711 58,150 60,528 63,027 65,465 67,903 70,342 72,780 75,219 77,657 78,747 79,158 79,271 78,027 79,158 79,271 78,027 79,158 79,271 78,027 79,158 79,271 78,027 79,158 79,271 78,027 79,158 79,271 78,027 79,158 79,271 78,027 79,158 79,271 78,027 79,158 79,271 78,027 71,158 79,271 78,027 79,158 79,271 78,027 71,158 79,271 78,027 71,158 79,271 78,027 79,158 79,271 78,027 79,158 79,271 78,027 79,158 79,271 78,027 79,158 79,271 79,158 79,271 78,027 79,158 79,271 78,027 79,158 79,271 78,027 79,158 79,271 78,027 79,158 79,271 78,027 79,158 79,271 78,027 79,158 79,271 79,158 79,271 79,158 79,271 79,158 79,271 79,158 79,271 79,158 79,271 79,158 79,271 79,158 79,271 79,158 79,271 79,158 79,271 79,158 79,271 79,158 79,271 79,158 79,271 79,158 79,271 79,158 79,271 78,007 79,158 79,271 78,007 78,007 78,007 79,158 79,271 78,007 78,0	351.3 Velocifi es sk Vert. Vel(m' s) 5.65 5.57 5.39 5.21 5.04 4.66 4.69 4.469 4.469 4.469 3.80 3.80 3.80 3.80 3.80 3.80 3.80 3.80	bet rting at er Plume Temp(K) 315.51 315.47 314.12 313.37 312.49 311.96 311.60 311.33 311.13 310.47 310.64 310.73 310.64 310.73 310.64 310.51 310.64 310.73 310.64 310.75 310.64 310.51 310.64 310.55 310.64 310.75 310.64 310.75 310.64 310.75 310.64 310.75 310.64 310.75 310.64 310.75 310.64 310.75 310.64 310.75 310.64 310.75 310.64 310.75 310.64 310.75 310.64 310.75 310.64 310.75 310.64 310.75 310.64 310.75 310.64 310.75 310.64 310.75 310.64 310.64 310.75 310.64 310.55 310.55 310.64 310.55 310.55 310.64 310.55 310.55 310.64 310.55 310.	Jet Pha se Jet Pha se V _{ρυτ} =((Va), a = 0.16(2. θ _p =θ ₂ (1+(1. Max<5.3 n	a se: Interpola to > 5.3m's u quations ² +0.12F ₀ (z-z, z,) (θ ₂ /θ ₂))*(V ₂)	s the real solution x = z-zv= or z(m) = z(ft) = ed p to ~350*ag1	-385.7550 -372.176
able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack Rel.Ht = 130.0 200.0 200.0 400.0 500.0 600.0 700.0 800.0 900.0 100	lume a verag (meters) above stack 0.00 6.10 6.10 6.12 82.30 112.78 82.30 112.78 143.26 173.74 204.22 224.70 2265.18 225.68 326.14 336.62 338.7.10 447.55 422.65 539.50 539	meters Plume Radius(m) 39,374 39,374 39,374 43,967 44,967 44,967 45,9	351.3 Velocifi es sk Vert. Vel(m' s) 5.69 5.57 5.39 5.21 5.04 4.66 4.69 4.69 4.469 4.51 3.30 3.345 3.346 3.30 3.445 3.30 3.345 3.30 3.445 4.55 3.30 3.445 4.55 4.55 4.55 4.55 4.55 4.55 4.5	bet arting at er Plume Temp(K) 315.51 315.47 314.12 313.31.96 311.60 311.33 311.13 310.97 310.64 310.57 310.64 310.57 310.64 310.57 310.45	Jet Phase Jet Phase V _{pum} ={(V3), a = 0.16(z- 0=0+(1+(1- Max<5.3 n	a se: Interpola to > 5.3m's u quations ² +0.12F ₀ (z-z, z,) (θ ₂ /θ ₂))*(V ₂)	s the real solution x = z-zv= or z(m) = z(ft) = ed p to ~350*ag1	-385.7550 -372.176
able of Plume Top-Hat Diameters (2a) and F Height (feet) above ground Stack ReLH = 130.0 200.0 200.0 400.0 500.0 600.0 700.0 800.0 900.0 1000.0 1100.0 1100.0 1100.0 1100.0 1100.0 1100.0 1100.0 1100.0 1100.0 1100.0 1100.0 1100.0 1200.0 1100.0 1200.	Jume a verag (meters) a bove stack 0.00 6.10 21.34 51.82 82.30 112.78 112.78 1143.26 1234 204.22 234.70 225.56 326.11 235.66.62 337.10 417.53 448.06 492.65 509.02 539.50 509.32 600.46 630.94 613.82 674.78 995.74 <tr< td=""><td>meters ed Vertical Plume Radius(m) 39,374 39,361 41,061 43,519 45,957 48,396 55,083 63,027 65,465 67,903 70,342 72,780 75,219 77,657 78,747 79,158 79,271 84,147 89,024 93,901 98,778 108,531 118,285 128,039 137,792 147,546 157,299 137,792 147,546 157,299 137,792 147,546 157,299 137,792 147,546 157,299 137,792 147,546 157,299 137,792 147,546 157,299 137,792 147,546 157,299 137,792 147,546 157,299 137,792 147,546 157,299 137,792 147,546 157,299 137,792 147,546 157,299 147,048 108,31 176,807 128,650 196,314 206,067 215,821</td><td>351.3 Velocifi es sk Vert. Vel(mi sj 5.69 5.57 5.39 5.21 5.04 4.68 4.69 4.51 3.38 3.416 3.380 3.63 3.63 3.45 3.22 3.38 3.40 3.380 3.45 3.22 3.38 3.40 3.380 3.45 3.22 3.38 3.40 3.38 3.40 3.39 4.55 4.64 4.69 4.64 4.69 4.64 4.69 4.64 4.69 4.65 4.65 4.65 4.65 4.65 4.65 4.65 4.65</td><td>bet arting at er Plume Temp(K) 315.51 315.47 314.12 313.37 312.49 311.96 311.96 311.93 311.84 311.97 310.84 310.57 310.64 310.57 310.50 310.55 310.50 310.50 310.50 310.50 310.50 310.50 310.50 310.50 310.50 310.50 310.50 310.50 310.50 310.50 310.50 310.50 310.50 311.50 311.50 311.50 311.50 311.50 311.50 311.50 312.40 311.50 310.50 310</td><td>Jet Phase Jet Phase Spillane E V_{pur}={(Va), a = 0.16(z- 0=0s(1+(1- Max<5.3 n</td><td>a se: Interpola to > 5.3m's u quations ²+0.12F₀(z-z, z,) (θ₂/θ₂))*(V₂)</td><td>s the real solution x = z-zv= or z(m) = z(ft) = ed p to ~350*ag1</td><td>-385.7550 -372.176</td></tr<>	meters ed Vertical Plume Radius(m) 39,374 39,361 41,061 43,519 45,957 48,396 55,083 63,027 65,465 67,903 70,342 72,780 75,219 77,657 78,747 79,158 79,271 84,147 89,024 93,901 98,778 108,531 118,285 128,039 137,792 147,546 157,299 137,792 147,546 157,299 137,792 147,546 157,299 137,792 147,546 157,299 137,792 147,546 157,299 137,792 147,546 157,299 137,792 147,546 157,299 137,792 147,546 157,299 137,792 147,546 157,299 137,792 147,546 157,299 137,792 147,546 157,299 147,048 108,31 176,807 128,650 196,314 206,067 215,821	351.3 Velocifi es sk Vert. Vel(mi sj 5.69 5.57 5.39 5.21 5.04 4.68 4.69 4.51 3.38 3.416 3.380 3.63 3.63 3.45 3.22 3.38 3.40 3.380 3.45 3.22 3.38 3.40 3.380 3.45 3.22 3.38 3.40 3.38 3.40 3.39 4.55 4.64 4.69 4.64 4.69 4.64 4.69 4.64 4.69 4.65 4.65 4.65 4.65 4.65 4.65 4.65 4.65	bet arting at er Plume Temp(K) 315.51 315.47 314.12 313.37 312.49 311.96 311.96 311.93 311.84 311.97 310.84 310.57 310.64 310.57 310.50 310.55 310.50 310.50 310.50 310.50 310.50 310.50 310.50 310.50 310.50 310.50 310.50 310.50 310.50 310.50 310.50 310.50 310.50 311.50 311.50 311.50 311.50 311.50 311.50 311.50 312.40 311.50 310.50 310	Jet Phase Jet Phase Spillane E V _{pur} ={(Va), a = 0.16(z- 0=0s(1+(1- Max<5.3 n	a se: Interpola to > 5.3m's u quations ² +0.12F ₀ (z-z, z,) (θ ₂ /θ ₂))*(V ₂)	s the real solution x = z-zv= or z(m) = z(ft) = ed p to ~350*ag1	-385.7550 -372.176

