

# Desalination Brine Dispersion Modeling using US EPA VP UM3

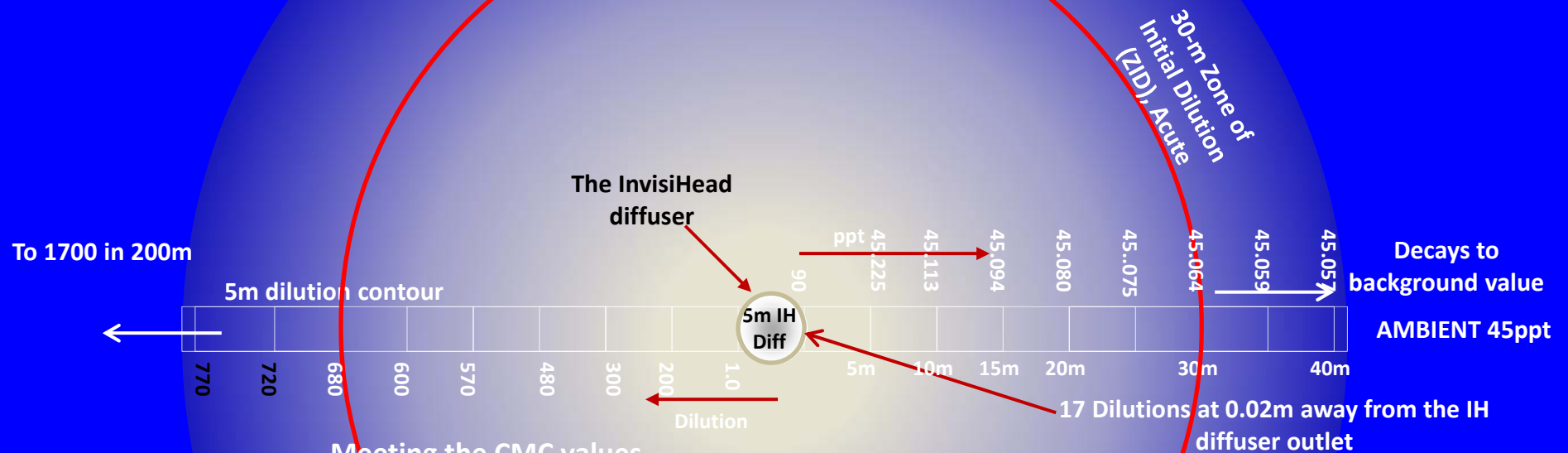
Efficient brine dispersion can be achieved by the InvisiHead diffuser discharging reverse osmosis seawater desalination concentrate or any brine disposing system. The 5m IH diffuses, disperses, spreads, mixes and dilutes brine as shown in the US EPA VP UM3 model below. Brine decays from 90 ppt to 47.7 ppt at 0.02m from the diffuser and reaches the required dilution of 17 the required level just after leaving the diffuser; it reaches 0.06 ppt at the edge of the ZID or acute zone 30m away from the diffuser



# THE INVISIHEAD

# DIFFUSER

By nature of the design, the InvisiHead diffuser releases effluent in spatial and temporal fashion or in a 4-D space + time domain that makes the flow to funnel out in a 360° round surround, 180° up, sideways, straight, and down. It discharges, funnels out and disperses, spreads, mixes and dilutes effluents to reach the required dilution within the vicinity of the diffuser early in the mixing zones; radial diffusion of effluents with multi directionality is what the InvisiHead exactly made to do.



## Meeting the CMC values

Dilution within the 300m Allocated Impact Zone (AIZ):

- 17 at 0.02m, 2.7ppt down from 90;
- 54 at 0.2m, 0.86 ppt;
- 393 at 11m, 0.12 ppt;
- 726 at 36m, 0.06 ppt at edge of ZID;
- 1701 at 200m, 0.03ppt;

## Meeting the Regulatory Mixing Zone (RMZ) distance from outfall diffuser

- Acute criteria met (CMC values) at the edge of ZID, acute mixing zone is 10% of chronic zone;
- Chronic criteria met (CCC values) at the AIZ or CMZ.

# Brine Diffusion and Decay Modeling using US EPA VP UM3

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Case 1; ambient file C:\Plumes\Brine.001.db; Diffuser table record 1: -----

Depth	Amb-cur	Amb-dir	Amb-sal	Amb-tem	Amb-pol	Decay	Far-spd	Far-dir	Disprsn
m	m/s	deg	psu	C	kg/kg	s-1	m/s	deg	m0.67/s2
0.0	0.05	90.0	45.0	31.0	45.0	0.0	4.1216E+8	4.1216E+8	0.0003
7.0	0.05	90.0	45.0	31.0	45.0	0.0	4.1216E+8	4.1216E+8	0.0003

P-dia	P-elev	V-angle	H-angle	Ports	Spacing	AcuteMZ	ChrnMZ	P-depth	Ttl-flo	Eff-sal	Temp	Polutnt
(m)	(m)	(deg)	(deg)	( )	(m)	(m)	(m)	(m)	(m3/s)	(psu)	(C)	(kg/kg)
6.00E-7	3.5	-10.0	90.0	1.68E+7	9.56E-9	35.0	350.0	3.5	2.045	90.0	35.0	90.0

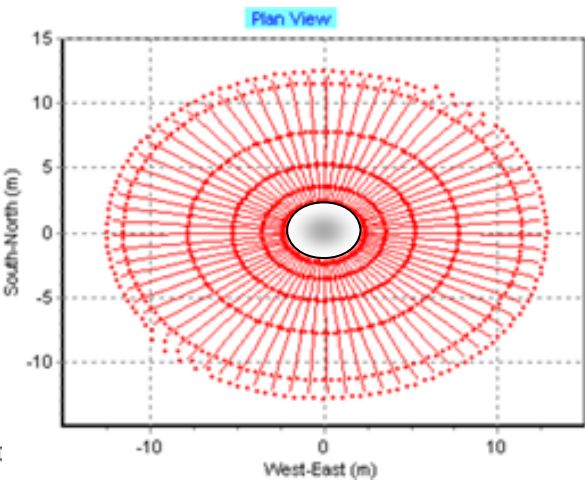
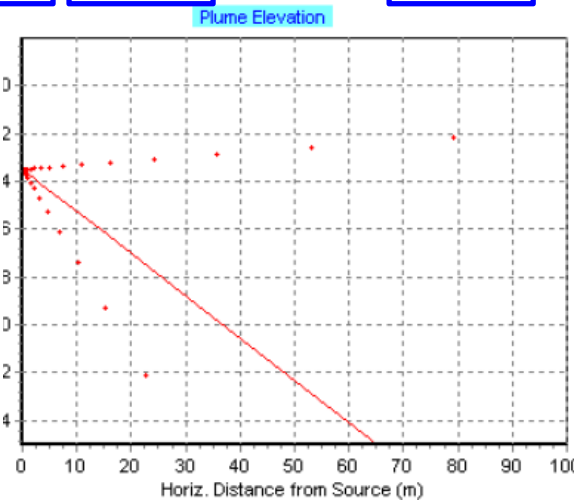
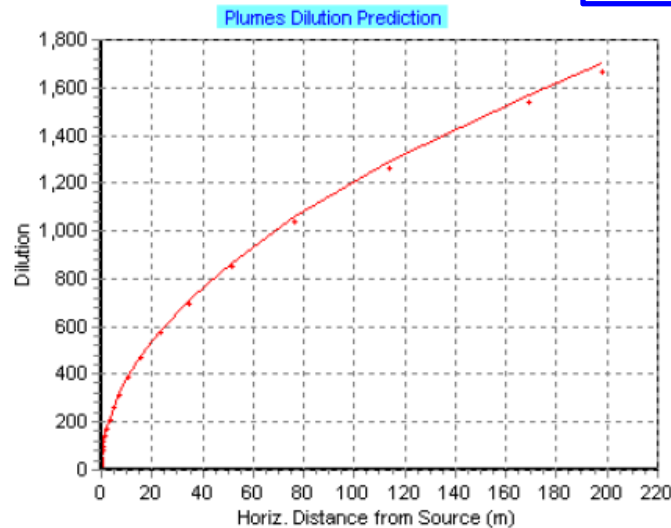
Froude number: -9.8692E+8

Step	Depth	Amb-cur	P-dia	Polutnt	Dilutn	x-posn	y-posn
	(m)	(m/s)	(m)	(kg/kg)	( )	(m)	(m)
0	3.5	0.05	6.000E-7	90.0	1.0	0.0	0.0

Step	Depth	Amb-cur	P-dia	Polutnt	Dilutn	x-posn	y-posn
100	3.501	0.05	0.0015	51.21	7.455	0.0	0.00376
142	3.504	0.05	0.00796	47.7	17.17	0.0	0.0202
200	3.535	0.05	0.0793	45.86	54.21	0.0	0.201
298	5.22	0.05	3.847	45.12	377.7	0.0	9.757
300	5.362	0.05	4.164	45.12	392.9	0.0	10.56
331	9.856	0.05	14.21	45.06	726.0	0.0	36.05
374	38.39	0.05	78.04	45.03	1701.3	0.0	197.9

max dilution reached  
bottom hit,  
acute zone,  
surface,



The InvisiHead diffuser discharges effluent in a round surround, side ways, up, straight, and down funneling out flow and efficiently managing effluent diffusion and dispersion.

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