

***** FLOW CLASS DESCRIPTION *****

The following description of flow class MNU7 applies to the FULL WATER DEPTH at the discharge site.

FLOW_CLASS_MNU7

(EQUIVALENT TO FLOW CLASS MU2)

A unidirectional multiport diffuser with perpendicular alignment is discharging into an ambient flow. Frequently, this is called a "co-flowing diffuser". The discharge configuration is hydrodynamically "unstable", that is the discharge strength (measured by its momentum flux) is very strong in relation to the layer depth and in relation to the stabilizing effect of the discharge buoyancy (measured by its buoyancy flux). Rapid vertical mixing takes place over the full layer depth.

The following flow zones exist:

1) Acceleration zone for unidirectional coflowing diffuser:
The net horizontal momentum flux provided by the diffuser jets leads to a wholesale acceleration of the ambient water, that flows across the diffuser line leading to rapid entrainment and mixing in this zone. The diffuser plume is mixed over the full layer depth, and contracts laterally in the direction of the flow (acceleration process). The length of this zone is about one half the diffuser length.

2) Diffuser-induced plume in co-flow: The diffuser induced momentum flux is still controlling the flow. However, lateral entrainment and diffusion lead to a spreading of the diffuser plume and additional mixing. The plume moves predominantly in the direction of the ambient flow. At the beginning, the plume is vertically mixed over the full layer depth. At some distance, stratification may take place depending on the strength and direction of the plume buoyancy.

*** The zones listed above constitute the NEAR-FIELD REGION in which strong initial mixing takes place. ***

3) Buoyant spreading at layer bottom: The plume spreads laterally along the layer boundary (bottom) while it is being advected by the ambient current. The plume thickness may decrease during this phase. The mixing rate is relatively small. The plume may interact with a nearby bank or shoreline.

4) Passive ambient mixing: After some distance the background turbulence in the ambient shear flow becomes the dominating mixing mechanism. The passive plume is growing in depth and in width. The plume may interact with the channel bottom and/or banks.

*** Predictions will be terminated in zone 3 or 4 depending on the definitions of the REGULATORY MIXING ZONE or the REGION OF INTEREST. ***

SPECIAL CASE: If the ambient is stagnant, then advection and diffusion by the ambient flow (zones 3 and 4) cannot be considered. The mixing is limited to the near-field region (zones 1 and 2) and the predictions will be terminated at this stage.

Such stagnant water predictions may be a useful initial mixing indicator for a given site and discharge design.

For practical final predictions, however, the advection and diffusion of the ambient flow - no matter how small in magnitude - should be considered.

END OF FLOW CLASS DESCRIPTION *****