Date: 09/22/00
Time: 08:22:12

Design Case: Summer Stratified
Site Name: A-Plant Deep Reservoir
Prepared By: RLD

Project Notes:
This example appears in the CORMIX User Manual Appendix B.

VALIDATING INPUT DATA ...

Checking Pages for invalid or missing inputs...

Ambient Page has been validated.
Effluent Page has been validated.
Discharge Page has been validated.
Mixing Zone Page has been validated.

Finished checking Pages for invalid or missing inputs.

Loading Correct RuleBases

Validating RuleBases ...

AMBIENT DATA

Equivalent Darcy-Weisbach friction factor = 0.010

Ambient surface density = 996.2053 kg/m^3.

Ambient bottom density = 999.6072 kg/m^3.

The ambient DENSITY PROFILE you have specified is DYNAMICALLY STABLE in the presence of the given ambient crossflow.   (This has been checked with a FLUX RICHARDSON NUMBER CRITERION).

Ambient Rule Base has been validated.

DISCHARGE DATA:
Entering subsystem CORMIX1: Submerged Single Port Discharges

Port cross-sectional area A0 = 0.051 m^2.

Discharge velocity U0= 3.019 m/s.

Discharge density RHO0 = 998.2051 kg/m^3.

Discharge Rules for CORMIX1 have been validated

MIXING ZONE SPECIFICATION:

TOXIC DILUTION ZONE (TDZ) Specifications:

Since the discharge is specified as toxic, the analysis will include a TDZ.

The pollutant concentration at the edge of the TDZ is subject to THREE (3) CRITERIA based on the Criterion Maximum Concentration (CMC) value:

Criterion 1: The CMC must be met within a distance of 50 times the discharge length scale in any spatial direction.

Criterion 2: The CMC must be met within a distance of 5 times the local water depth in any horizontal direction from the outfall.

Criterion 3: The CMC must be met within 10% of the distance from the edge of the outfall structure to the edge of the regulatory mixing zone if a regulatory mixing zone is specified.

Also, it is RECOMMENDED that the discharge exit velocity exceed 3 m/s.

In addition, the Criterion Continuous Concentration (CCC) value specified must be met at the edge of the Regulatory Mixing Zone if such is specified.

Reference: Technical Support Document for Water Quality-Based Toxics Control, USEPA, 1991 (EPA/505/2-90-001).

REGULATORY MIXING ZONE (RMZ) Specifications:

In general practice, there are two possible interpretations for the RMZ:

Interpretation 1: The RMZ is a spatially defined (by State/Federal agencies) restricted region at whose boundary a specified water quality standard for conventional pollutants - or the CCC for toxic pollutants - has to be met.

Interpretation 2: The applicant or the State/Federal agency may propose on an ad-hoc basis an RMZ as that region at whose boundary a water quality standard - or CCC - has been demonstrated to be met. That demonstration is usually made by means of a mixing zone prediction.

CORMIX will evaluate the RMZ conditions on the basis of both interpretations.

Mixing Zones Rule Base has been validated.

Finished validating RuleBases.

Calculating Parameters.

FLOW PARAMETERS AND LENGTH SCALES:

Relative density differences between discharge and ambient:

Ambient density at the discharge level RHOAH0 = 999.5599 kg/m^3.
Surrogate ambient density at discharge level RHOAH0S = 999.4755 kg/m^3.
Vertical mean ambient density RHOAM = 997.6240 kg/m^3.

The effluent density (998.2051 kg/m^3) is less than the surrounding ambient water density at the discharge level (999.5599 kg/m^3).

Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards the surface.

Flow bulk parameters:

Discharge volume flux Q0 = 0.153 m^3/s.
Discharge momentum flux M0 = 0.46198 m^4/s^2.

Discharge buoyancy flux J0 = 0.002034 m^4/s^3.
Surrogate discharge buoyancy flux J0S = 0.001907 m^4/s^3.

Flow length scales:

Jet-to-crossflow length scale Lm = 45.31 m.

Plume-to-crossflow length scale Lb = 602.58 m.

Discharge length scale LQ = 0.2251 m.

Jet-to-plume transition length scale LM = 12.43 m.

Jet stratification length scale Lm' = 4.95 m.
Surrogate jet stratification length scale Lm's = 3.83 m.
Plume stratification length scale Lb' = 3.12 m.
Surrogate plume stratification length scale Lb's = 2.12 m.
The surrogate length scales assume an equivalent linear stratification including the density jump in the lower layer.

Non-dimensional parameters:

Densimetric Froude number FR0 = 51.97
Jet/crossflow velocity ratio R = 201.30

Parameters for CORMIX1 have been calculated

Classifying Flows.

FLOW CLASSIFICATION:

CORMIX1 includes FOUR MAJOR CLASSES of possible flow configurations:
Classes S: Flows trapped in a layer within linear stratification.
Classes V, H: Positively buoyant flows in a uniform density layer.
Classes NV, NH: Negatively buoyant flows in uniform density layer.
Classes A: Flows affected by dynamic bottom attachment.

The NEAR FIELD FLOW will have the following features:

If flow trapping occurs, then the flow is jet-like and is strongly affected by the ambient density stratification with a weak crossflow effect (if any).

The specified two layer ambient density stratification is dynamically important. The discharge near field flow will be confined to the lower layer by the ambient density stratification.

Furthermore, it may be trapped below the ambient density jump at the pycnocline.

The discharge near-field behavior is dominated by either the positive buoyancy of the discharge or the upward vertical orientation of the discharge port.

There is the possibility of dynamic bottom attachment.

The following conclusion on the NEAR-FIELD FLOW CONFIGURATION applies to the LOWER LAYER ONLY of the specified ambient stratification condition C.

Note that the lower layer will be overlaid by the surface layer of the ambient

density stratification. The surface layer will remain undisturbed by the near field discharge flow (with the exception of some possible intrusion along the pycnocline):

*** FLOW CLASS = S3 ***

Applicable layer depth HS = 15.5 m.

Flow has been classified.

Executing the simulation... FORTRAN simulation complete.

Generating Session Report... Session Report complete.