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CORMIX2 PREDICTION FILE:
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                        CORMIX MIXING ZONE EXPERT SYSTEM
                Subsystem CORMIX2: Multiport Diffuser Discharges
                             CORMIX Version 12.0G
                      HYDRO2 Version 12.0.1.0 August 2021
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CASE DESCRIPTION
 Site name/label:   Moody Lane Grimsby
 Design case:       Grimsby Case A Cd WHO
 FILE NAME:         C:\...\Documents\Fichtner Grimsby\GRI_Cd_Case A WHO.prd
 Time stamp:        12/04/2025--08:45:07

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =   5300.00  AS    =  23320.00  QA    =    233.20  ICHREG= 1
 HA    =      4.40  HD    =      3.40
 UA    =     0.010 F     =     0.011 USTAR =0.3670E-03
 UW    =     3.800 UWSTAR=0.4358E-02
 Uniform density environment
 STRCND=  U         RHOAM = 1018.0000

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =    504.00  YB1   =    500.00  YB2   =    508.00
 LD    =      8.00  NOPEN =    3       NRISER=    3       SPAC  =      4.00
NPPERR =    1
 D0    =     0.060 A0    =     0.003 H0    =      0.50  SUB0  =      2.90
 D0INP =     0.060 CR0   =     1.000 B0    =0.7069E-03
 Nozzle/port arrangement:   unidirectional_with_fanning
 GAMMA =     90.00  THETA =     10.00  SIGMA =      0.00  BETA  =     90.00
 U0    =     10.097 Q0    =     0.086 Q0A   =0.8565E-01
 RHO0  = 1001.0000  DRHO0 =0.1700E+02  GP0   =0.1638E+00
 C0    =0.1010E+02  CUNITS=  ppb
 IPOLL =  1         KS    =0.0000E+00  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.1071E-01         SIGNJ0=      1.0
 m0 =U0^2*B0 =0.7207E-01   j0 =U0*GP0*B0 =0.1169E-02   (based on slot width B0)
 m0 =U0*q0   =0.1081E+00   j0 =q0*GP0    =0.1753E-02   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =      0.001 lM    =      6.48  lm    =   1081.06
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.8565E-01  M0    =0.5766E+00  J0    =0.9351E-02
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 Associated 3-d length scales (meters)
 LQ    =      0.05  LM    =      6.84  Lm    =     93.00  Lb    =  14026.50
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =    938.51  FRD0  =    101.87  R     =   1009.75  PL    =   44.29
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =     10.097 D0    =      0.060 A0    =      0.003 THETA =     10.00
 FR0   =    938.51  FRD0  =    101.87  R     =   1009.75
 (slot)             (riser group)

FLOW CLASSIFICATION
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 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     3.40        2
 2  Limiting Dilution S=QA/Q0 + 1=  2723.71     2
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MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.1010E+02  CUNITS=  ppb
 NTOX  =  0
 NSTD  =  1         CSTD  =0.3000E+01
 REGMZ =  1
 REGSPC=  1         XREG  =    100.00  WREG  =      0.00  AREG  =      0.00
 XINT  =  53000.00  XMAX  =  53000.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
       504.00 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
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BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time
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       X        Y       Z        S       C        BV       BH       Uc        TT
      0.00     0.00    0.50     1.0 0.101E+02   0.00     4.00    10.088
.00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
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BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 Because of the FANNED-OUT HORIZONTAL ORIENTATION of the diffuser jets,
   the near-field dilution is slightly improved.

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    3.40m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

       X        Y       Z        S       C        BV       BH        TT
      0.00     0.00    0.50     1.0 0.101E+02   0.00     4.00 .00000E+00
** WATER QUALITY STANDARD OR CCC HAS BEEN FOUND **
 The pollutant concentration in the plume falls below water quality standard
   or CCC value of 0.300E+01 in the current prediction interval.
 This is the spatial extent of concentrations exceeding the water quality
   standard or CCC value.
      0.40     0.00    0.53    15.1 0.670E+00   0.34     3.50 .58818E+00
      0.80     0.00    0.56    20.9 0.483E+00   0.68     3.13 .16221E+01
      1.20     0.00    0.58    25.4 0.398E+00   1.02     2.85 .29410E+01
      1.60     0.00    0.61    29.1 0.347E+00   1.36     2.62 .44877E+01
      2.00     0.00    0.64    32.5 0.311E+00   1.70     2.44 .62291E+01
      2.40     0.00    0.67    35.5 0.285E+00   2.04     2.30 .81430E+01
      2.80     0.00    0.70    38.2 0.264E+00   2.38     2.20 .10213E+02
      3.20     0.00    0.73    40.8 0.248E+00   2.72     2.14 .12426E+02
      3.60     0.00    0.75    43.2 0.234E+00   3.06     2.10 .14773E+02
      4.00     0.00    0.78    45.5 0.222E+00   3.40     2.09 .17244E+02
 Cumulative travel time =          17.2440 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
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BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

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 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH        TT
     4.00     0.00    3.40    45.5 0.222E+00   3.40     2.36 .17244E+02
 ** REGULATORY MIXING ZONE BOUNDARY is within the Near-Field Region **
 In this prediction interval the plume DOWNSTREAM distance meets or exceeds
 the regulatory value =   100.00 m.
 This is the extent of the REGULATORY MIXING ZONE.
    764.86     0.00    3.40   268.9 0.376E-01   0.64   373.77 .51923E+05
   1525.72     0.00    3.40   377.5 0.268E-01   0.55   799.74 .14414E+06
   2286.58     0.00    3.40   461.3 0.219E-01   0.49  1253.61 .26307E+06
   3047.45     0.00    3.40   532.0 0.190E-01   0.46  1727.09 .40367E+06
   3808.31     0.00    3.40   594.3 0.170E-01   0.43  2215.97 .56300E+06
   4569.17     0.00    3.40   650.8 0.155E-01   0.41  2717.67 .73908E+06
   5330.03     0.00    3.40   702.6 0.144E-01   0.39  3230.40 .93043E+06
   6090.89     0.00    3.40   751.0 0.134E-01   0.37  3752.87 .11359E+07
   6851.75     0.00    3.40   796.4 0.127E-01   0.36  4284.06 .13546E+07
   7612.61     0.00    3.40   839.3 0.120E-01   0.35  4823.20 .15858E+07
 Cumulative travel time =     1585845.2500 sec  (  440.51 hrs)

Note:
CORMIX is a steady state model and assumes discharge and ambient conditions do not
vary
 over time. The predicted plume cumulative travel time exceeds 48 hours at this
trajectory
 distance. Keep in mind that ambient and discharge conditions are likely to vary
over
 large space and time scales. Predictions at such large space and time scales may
be
 inconsistent with CORMIX modeling assumptions.

Please carefully evaluate your simulation results and limit model interpretation to
space
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 and time scales consistent with steady state assumptions and ambient
schematization.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
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** End of NEAR-FIELD REGION (NFR) **

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  1.47 to conserve the mass flux in the far-field!
 Some BOUNDARY INTERACTION with both banks occurs at end of near-field.
   The dilution values in one or more of the preceding zones may be too high.
 Carefully evaluate results in near-field and check degree of interaction.
 Bottom coordinate for FAR-FIELD is determined by average depth, ZFB = -1.00m
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BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 An UPSTREAM INTRUDING WEDGE is formed along the surface/pycnocline.

 UPSTREAM WEDGE INTRUSION PROPERTIES in bounded channel (laterally uniform):
        Wedge length                          =    2662.48 m
        X-Position of wedge tip               =    4950.13 m
        Thickness at discharge (end of NFR)   =       1.36 m
         (Wedge thickness gradually decreases to zero at wedge tip.)

 In this case, the upstream INTRUSION IS VERY LARGE, exceeding 10 times
   the local water depth.
 This may be caused by a very small ambient velocity, perhaps in combination
   with large discharge buoyancy.
 If the ambient conditions are strongly transient (e.g. tidal), then the
   CORMIX steady-state predictions of upstream intrusion are probably
   unrealistic.
 The plume predictions prior to boundary impingement and wedge formation
  will be acceptable, however.

       X        Y       Z        S       C       BV       BH      ZU      ZL
TT
   7612.61   504.00    3.40   839.3 0.120E-01   1.36  5300.00    3.40    2.04
.15858E+07
 Cumulative travel time =     1585845.2500 sec  (  440.51 hrs)

Note:
CORMIX is a steady state model and assumes discharge and ambient conditions do not
vary
 over time. The predicted plume cumulative travel time exceeds 48 hours at this
trajectory
 distance. Keep in mind that ambient and discharge conditions are likely to vary
over
 large space and time scales. Predictions at such large space and time scales may
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be
 inconsistent with CORMIX modeling assumptions.

Please carefully evaluate your simulation results and limit model interpretation to
space
 and time scales consistent with steady state assumptions and ambient
schematization.
 Flow is LATERALLY MIXED over the channel width.

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
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BEGIN MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

  Vertical diffusivity (initial value)   = 0.297E-02 m^2/s
  Horizontal diffusivity (initial value) = 0.371E-02 m^2/s

 Profile definitions:
   BV = Gaussian s.d.*sqrt(pi/2) (46%) thickness, measured vertically
      = or equal to layer depth, if fully mixed
   BH = Gaussian s.d.*sqrt(pi/2) (46%) half-width,
        measured horizontally in Y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL
TT
   7612.61   504.00    3.40   839.3 0.120E-01   1.36  5300.00    3.40    2.04
.15858E+07
  12151.35   504.00    3.40  2723.7 0.371E-02   4.40  5300.00    3.40    0.00
.20397E+07
 Effluent is FULLY MIXED over the entire channel cross-section.
 Except for possible far-field decay or reaction processes, there are
     NO FURTHER CHANGES with downstream direction.
  16690.09   504.00    3.40  2723.7 0.371E-02   4.40  5300.00    3.40    0.00
.24936E+07
  21228.83   504.00    3.40  2723.7 0.371E-02   4.40  5300.00    3.40    0.00
.29475E+07
  25767.57   504.00    3.40  2723.7 0.371E-02   4.40  5300.00    3.40    0.00
.34013E+07
  30306.31   504.00    3.40  2723.7 0.371E-02   4.40  5300.00    3.40    0.00
.38552E+07
  34845.05   504.00    3.40  2723.7 0.371E-02   4.40  5300.00    3.40    0.00
.43091E+07
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  39383.79   504.00    3.40  2723.7 0.371E-02   4.40  5300.00    3.40    0.00
.47630E+07
  43922.52   504.00    3.40  2723.7 0.371E-02   4.40  5300.00    3.40    0.00
.52168E+07
  48461.26   504.00    3.40  2723.7 0.371E-02   4.40  5300.00    3.40    0.00
.56707E+07
  53000.00   504.00    3.40  2723.7 0.371E-02   4.40  5300.00    3.40    0.00
.61246E+07
 Cumulative travel time =     6124584.0000 sec  ( 1701.27 hrs)

Note:
CORMIX is a steady state model and assumes discharge and ambient conditions do not
vary
 over time. The predicted plume cumulative travel time exceeds 48 hours at this
trajectory
 distance. Keep in mind that ambient and discharge conditions are likely to vary
over
 large space and time scales. Predictions at such large space and time scales may
be
 inconsistent with CORMIX modeling assumptions.

Please carefully evaluate your simulation results and limit model interpretation to
space
 and time scales consistent with steady state assumptions and ambient
schematization.

 Simulation limit based on maximum specified distance =  53000.00 m.
   This is the REGION OF INTEREST limitation.

END OF MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT
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CORMIX2: Multiport Diffuser Discharges       End of Prediction File
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