

Air Pollution Modeling

What you need to Know about Criteria Pollutant and Air Toxics Modeling

CAPCA - Spring 2005



Step 1

- What are your emissions?
 - NAAQS (CO, NO_x, SO₂, TSP, PM₁₀, PM_{2.5}, O₃^{*})
 - State List of Air Toxics
 - Each state has separate list (Forsyth, Mecklenburg, and Western NC use NC Listing)
 - Each state has different thresholds
 - MEK -- NC, 78 lbs/day
 - SC, 177 lbs/day
 - If over threshold, then modeling is likely needed

Step 2

- Then --
 - Evaluate impacts on NAAQS beyond property boundaries and/or
 - Determine if concentrations of TAPs are above ...
 - NC -- AAL
 - SC -- MAAC
 - This is conducted by modeling to insure no significant impact

Step 3

- Conduct Modeling
 - Determine computer model to be used
 - Simple models (SCREEN3)
 - More comprehensive models (ISCST3, AEROMOD)
 - Who is going to do the modeling?
 - NC will help, SC wants you to do the modeling
 - Create protocol as needed
 - Collect needed data

Step 4

- Do some modeling!!!
 - Computer programs from EPA and other vendors
 - www.epa.gov/ttn
 - See vendors in Exhibition Hall!
 - Insert data (some are simpler than others)
 - Run model -- see what happens
 - Probably start with SCREEN3 (pre-determined weather)
 - Then get more sophisticated -- ISCST3, AERMOD, etc. (run with real weather data and topography with AEROMOD)

```
MS SCREEN3
Auto
***** SCREEN3 MODEL *****
**** VERSION DATED 96043 ****

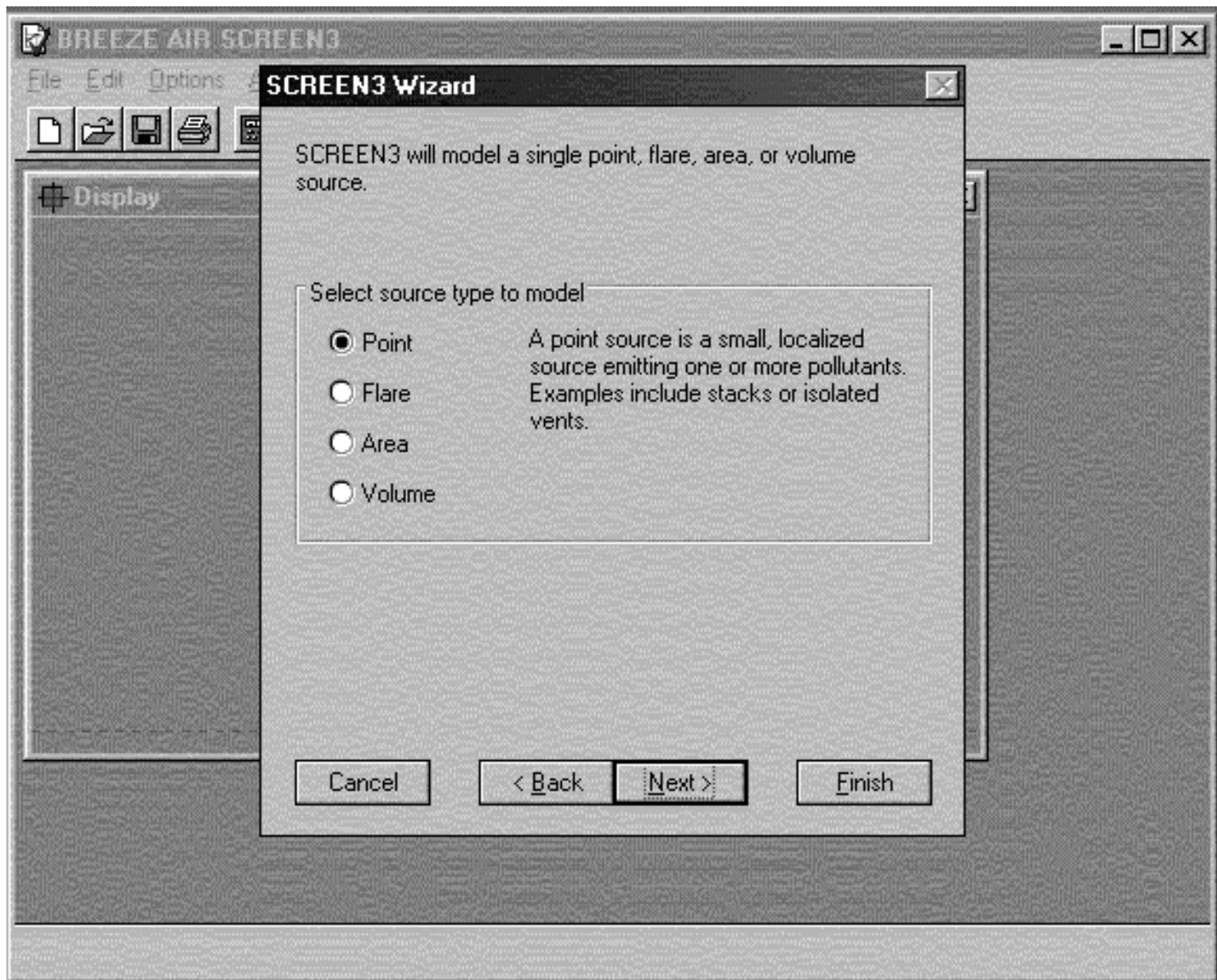
ENTER TITLE FOR THIS RUN (UP TO 79 CHARACTERS):
CAPCA Test Model for Emissions

ENTER SOURCE TYPE: P    FOR POINT
                   F    FOR FLARE
                   A    FOR AREA
                   V    FOR VOLUME

ALSO ENTER ANY OF THE FOLLOWING OPTIONS ON THE SAME LINE:

  N    - TO USE THE NON-REGULATORY BUT CONSERVATIVE BRODE 2
        MIXING HEIGHT OPTION,
  nn.n - TO USE AN ANEMOMETER HEIGHT OTHER THAN THE REGULATORY
        (DEFAULT) 10 METER HEIGHT.
  SS   - TO USE A NON-REGULATORY CAVITY CALCULATION ALTERNATIVE
Example - PN 7.0 SS (entry for a point source)

ENTER SOURCE TYPE AND ANY OF THE ABOVE OPTIONS:
```



```
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Auto
***** SCREEN3 MODEL *****
**** VERSION DATED 96043 ****

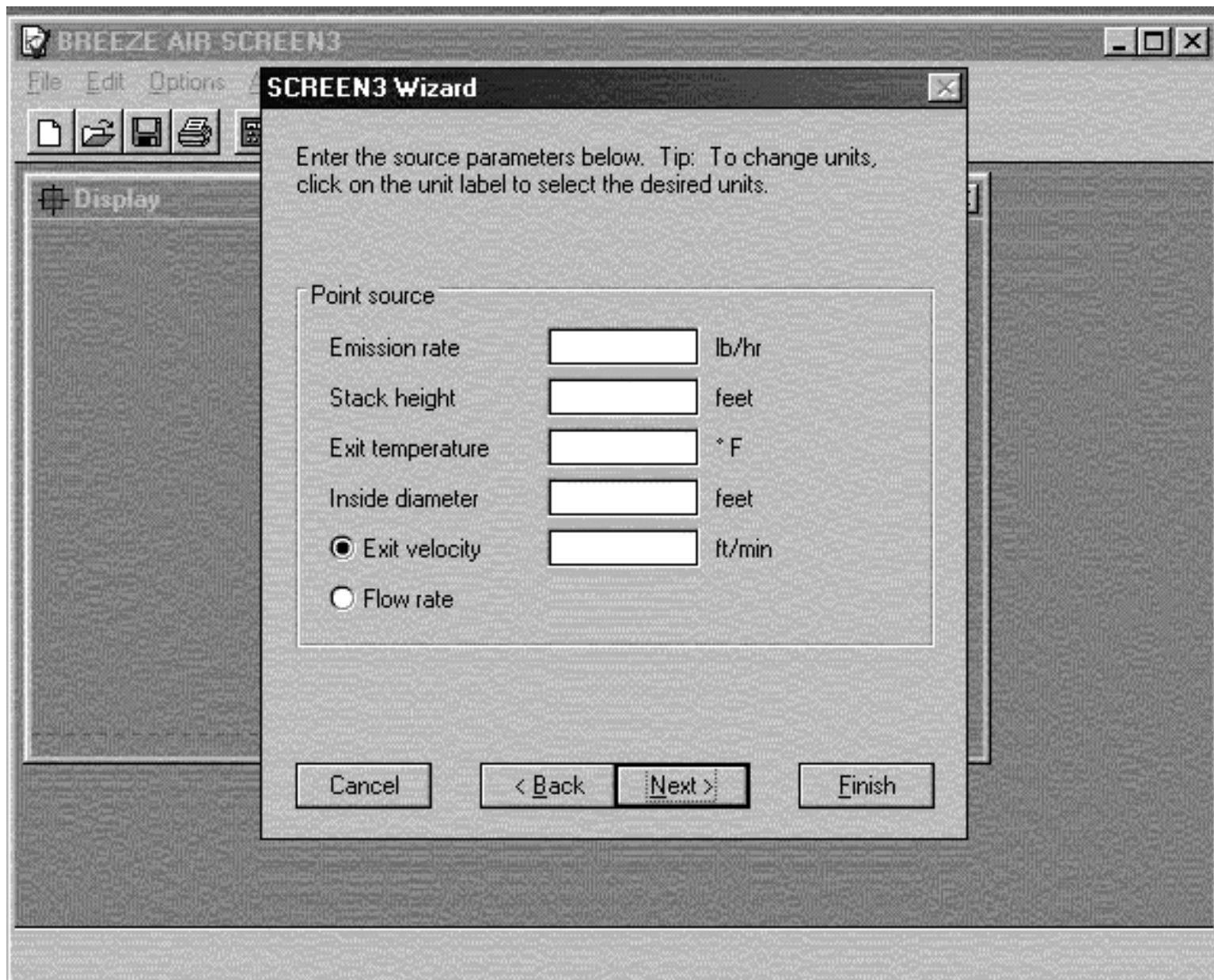
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Example - PN 7.0 SS (entry for a point source)

ENTER SOURCE TYPE AND ANY OF THE ABOVE OPTIONS:
p
ENTER EMISSION RATE (G/S):
0.5
ENTER STACK HEIGHT (M):
12
```



```

BREEZE AIR SCREEN3 - MATEAM1.DAT - [Output File - MATEAM1.LST]
File Edit Options Analysis Tools Window Help
06/23/97
10:44:05

*** SCREEN3r MODEL RUN ***
*** VERSION DATED 96043 ***

MATTHEWS, EPI-001, ETHYL ACETATE, MAX LOADING ** 142.9512

SIMPLE TERRAIN INPUTS:
SOURCE TYPE = POINT
EMISSION RATE (G/S) = 26.2076
STACK HEIGHT (M) = 20.1168
STK INSIDE DIAM (M) = 2.4384
STK EXIT VELOCITY (M/S) = 10.1102
STK GAS EXIT TEMP (K) = 463.7056
AMBIENT AIR TEMP (K) = 293.0000
RECEPTOR HEIGHT (M) = .0000
URBAN/RURAL OPTION = URBAN
BUILDING HEIGHT (M) = 7.9248
MIN HORIZ BLDG DIM (M) = 148.2242
MAX HORIZ BLDG DIM (M) = 212.5980

THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.

BUOY. FLUX = 54.252 M**4/S**3; MOM. FLUX = 96.006 M**4/S**2.

*** FULL METEOROLOGY ***

*****
*** SCREEN AUTOMATED DISTANCES ***
*****

*** TERRAIN HEIGHT OF 0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

DIST CONC U10M USTK MIX HT PLUME SIGMA SIGMA
(M) (UG/M**3) STAB (M/S) (M/S) (M) HT (M) Y (M) Z (M) DWASH
-----
143. 198.1 4 20.0 23.8 6400.0 32.85 22.33 19.70
200. 201.3 4 20.0 23.8 6400.0 32.85 30.89 27.31
300. 161.5 4 10.0 11.9 3200.0 52.90 45.82 40.75
400. 136.3 4 8.0 9.5 2560.0 62.93 60.24 53.83
500. 113.9 4 8.0 9.5 2560.0 62.93 73.92 66.27
600. 112.8 6 2.0 2.5 10000.0 89.22 62.47 40.03
700. 140.0 6 1.5 1.8 10000.0 96.18 71.44 44.74
800. 166.5 6 1.0 1.2 10000.0 107.18 80.53 49.81
900. 188.3 6 1.0 1.2 10000.0 107.18 88.46 53.15
1000. 204.6 6 1.0 1.2 10000.0 107.18 96.24 56.38

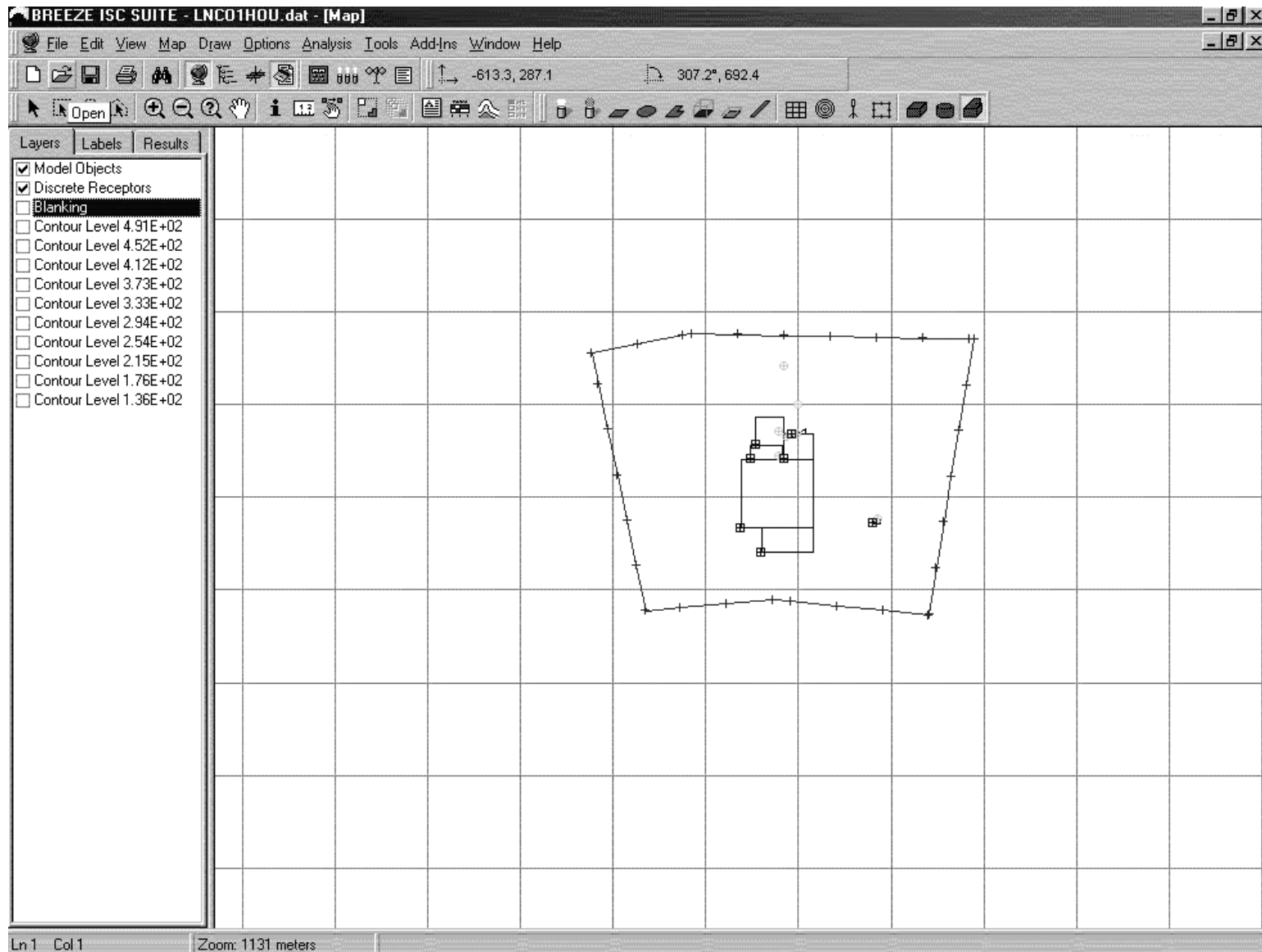
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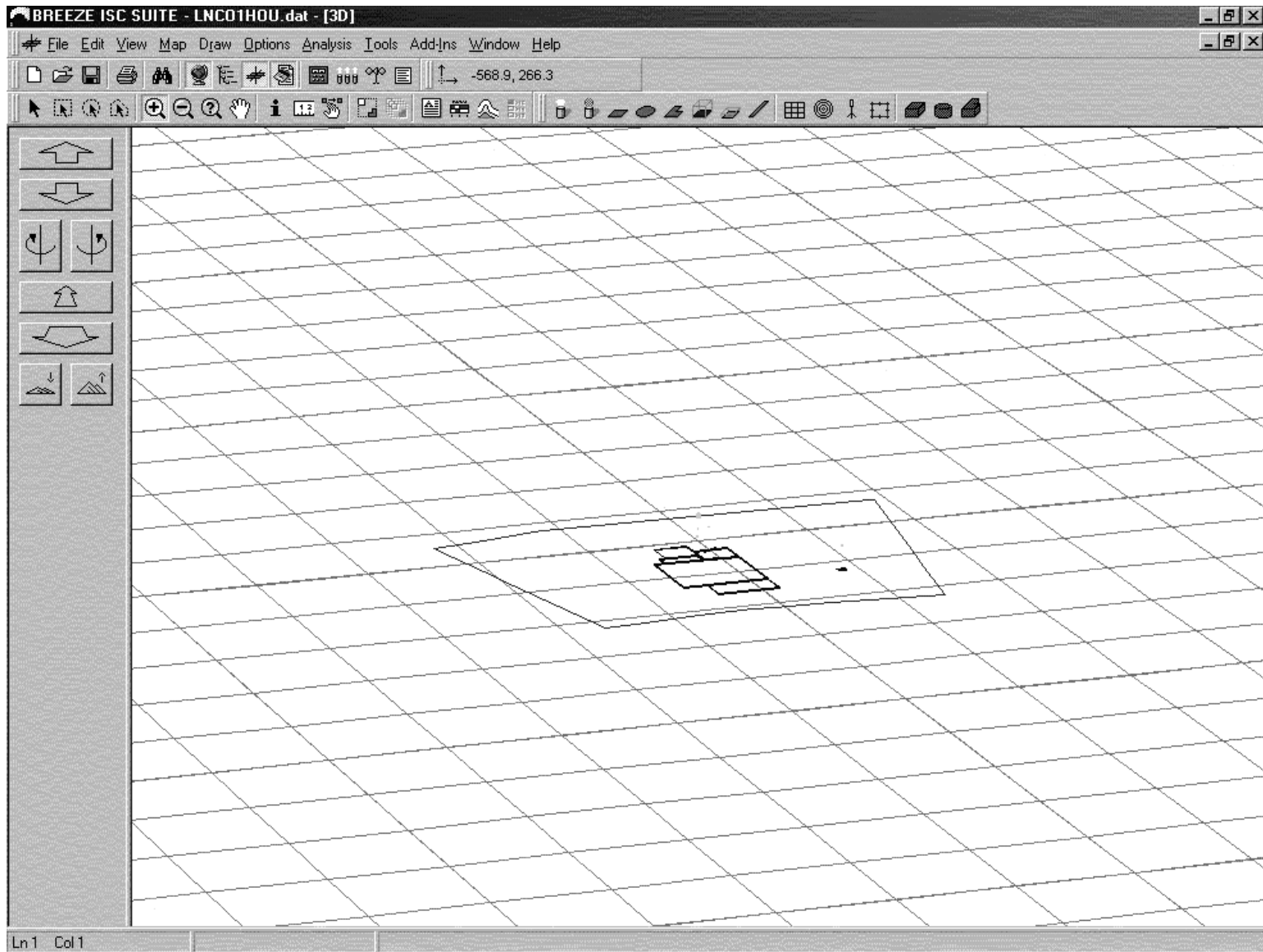


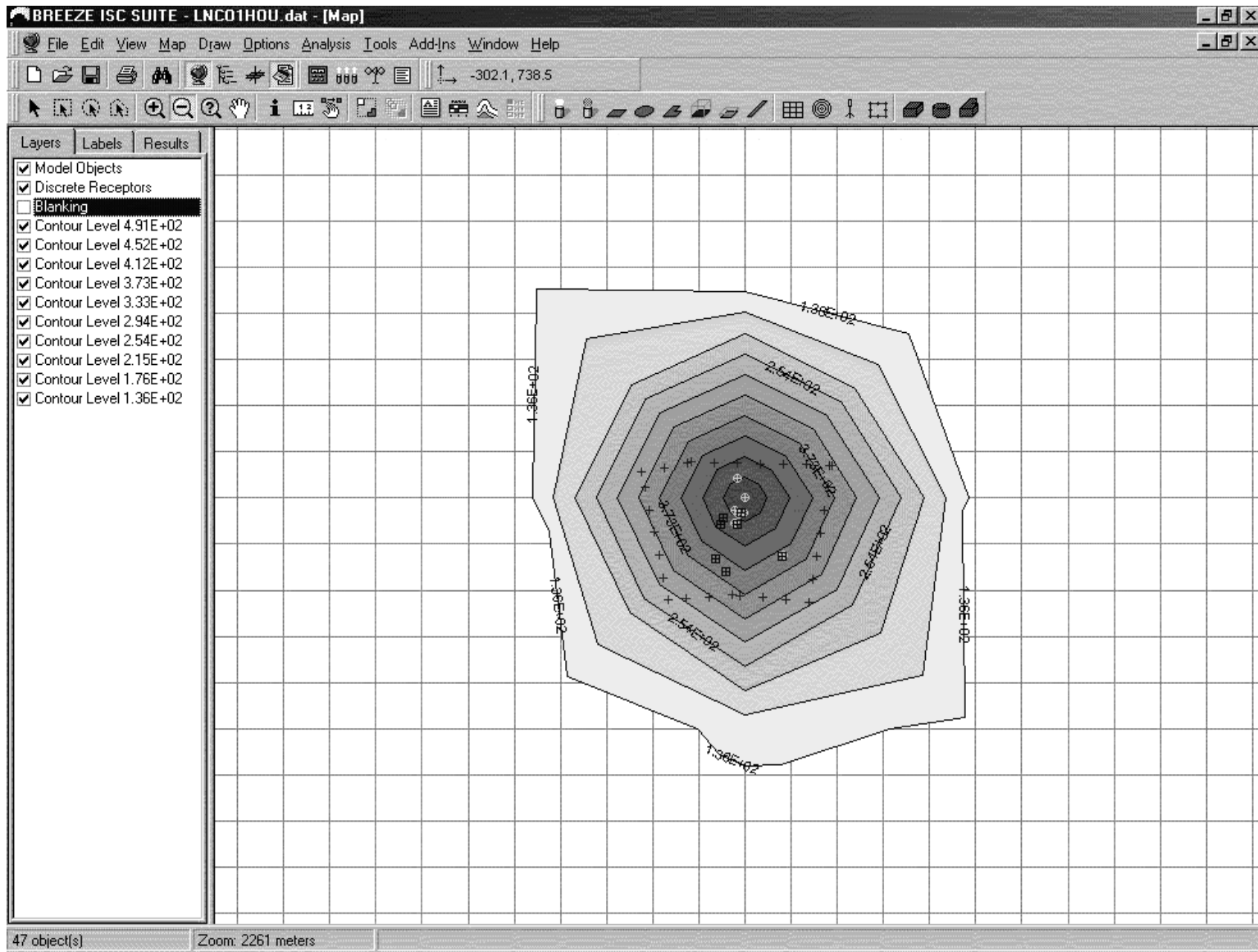
More Sophisticated Modeling?

Smoke that Computer!!!

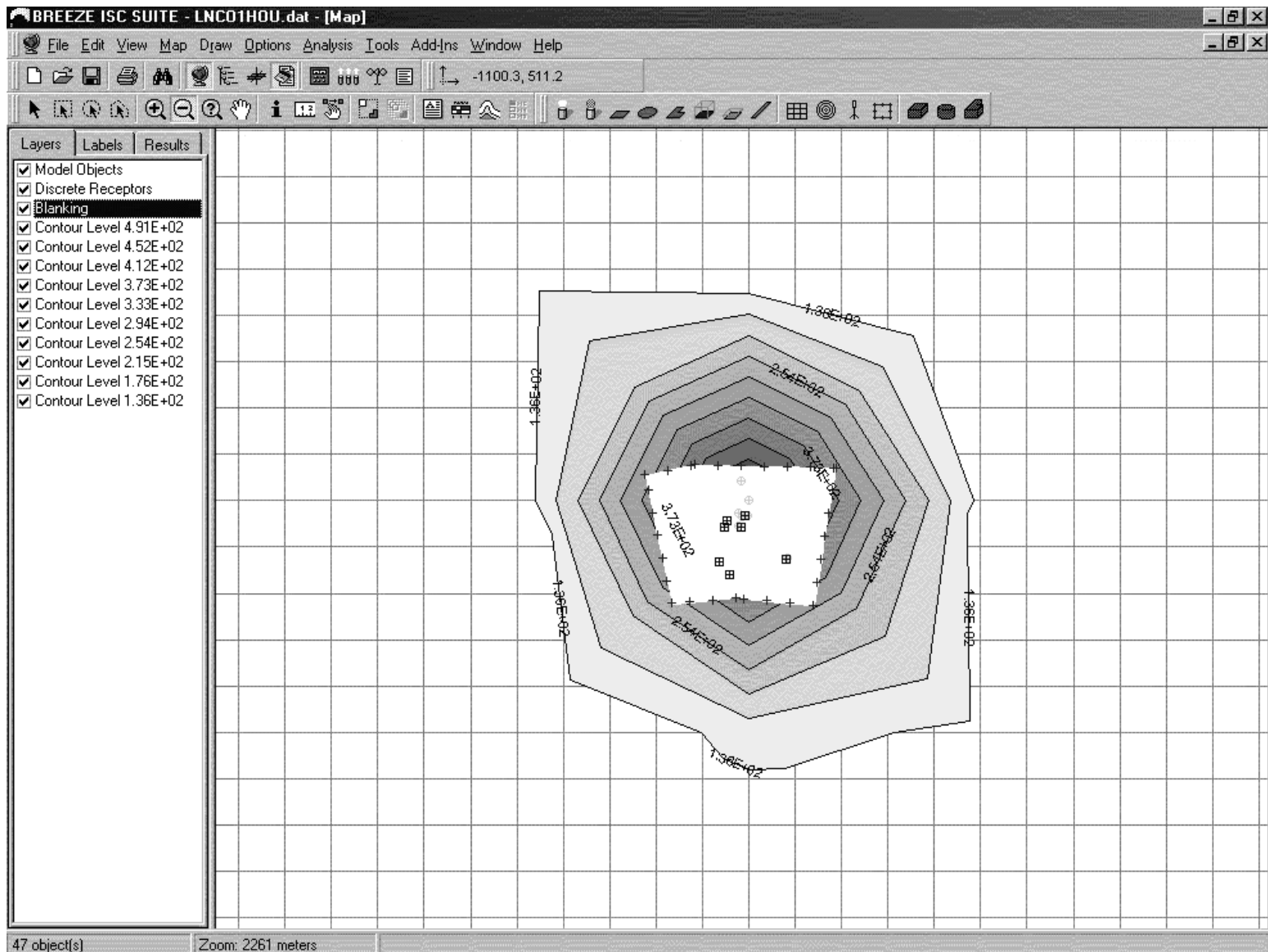
This is going to
take some time!







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Step 5

- Compare findings to NAAQS or State Toxics Limit
 - For NAAQS, be sure to add any background
 - If below, breathe a sigh of relief
 - If above, you need to contact your state regulatory staff --
“Houston, We Have A Problem!”

Step 6

“Houston, We Have A Problem!”

- Consider the following –
 - Change fuel or chemistry
 - Add/Improve control equipment
 - Change characteristics of discharge
 - Vertical instead of horizontal
 - Location at the site
 - Higher discharge up to GEP

Step 7

- Last step
 - Format report and submit to applicable regulatory agency for review
 - Expect a question or two
 - Keep a copy – can be used during permit renewal or can sometimes be used for other purposes
 - Keep electronic files available



Thank You!!!