HEALTH RISK ASSESSMENT AT AN INDUSTRIAL WASTEWATER TREATMENT FACILITY

Tinker Air Force Base, Oklahoma

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INVESTIGATION OVERVIEW

Outline

- Introduction
- Project Overview
- Distinctive Elements of Effort
- Air Emission Model
- Air Dispersion Model
- Coupled Model Validation / Calibration Process
- Coupled Model Results
- Comparison to Remote Optical Monitoring System
- Application to Risk Assessment
- Summary and Conclusions

TINKER AFB, OKLAHOMA

Introduction

- Tinker AFB covers 5,031 acres
  - *Only 200 acres are undeveloped*
- 765 Facilities
  - *15.3M feet^2 of industrial operations*
- Three Creek Systems
- 700-plus Air Emission Sources
- 200 Underground Storage Tanks
- 11-Miles Industrial Wastewater Lines
- Three Wastewater Treatment Plants
- 36 Restoration Sites
- Provides Logistics Support to USAF Weapon Systems
  - *B-1, B-52, E-3 Sentry, C/KC-135 aircraft*

TINKER AFB, OKLAHOMA

Introduction [CONTD]

- Tinker AFB performs Depot Level Maintenance
- Process Assessment identified four Primary Processes
  - *Depainting, Painting, Electroplating & Cleaning*
  - *Majority of processes discharge to an on-base treatment facility*
- Regulatory Requirement to quantify Air Emissions from Industrial Wastewater Treatment Facility [IWTF]
  - *Toxic Release Inventory and Air Emission Inventory*
  - *Clean Air Act Title V permit requires source & emission information*
  - *POTW NESHAP requirement*
- Efforts focus on Methylene Chloride and Phenol
  - *Both are CAA Title III Listed Hazardous Air Pollutants [HAPs]*
  - *VOC and semi-VOC examples*
  - *These chemicals account for majority of purchases / releases*

HEALTH RISK ASSESSMENT

Project Overview

- Investigation will be presented in four Major Tasks
- Coupling of Emission and Dispersion Models represents a Cost-Effective and Environmentally-Responsible Approach
  - *Coupling refers to sequential use of models [output is input]*
  - *Meet impact predictions, regulatory reporting requirements, and pollution prevention needs*
  - *Estimate emissions from IWTP process units*
    - ➢ *WATER8 air emission model developed by EPA*
  - *Estimate atmospheric dispersion concentrations*
    - ➢ *ISC-ST3 air dispersion model designed by EPA*

  Coupled Model

  - *Validate predictive accuracy of the coupled model*
    - ➢ *Comparison of coupled model predictions to field data*
    - ➢ *Comparison of coupled model predictions to OP-FTIR data*
  - *Demonstrate potential applications to include Risk Assessment*

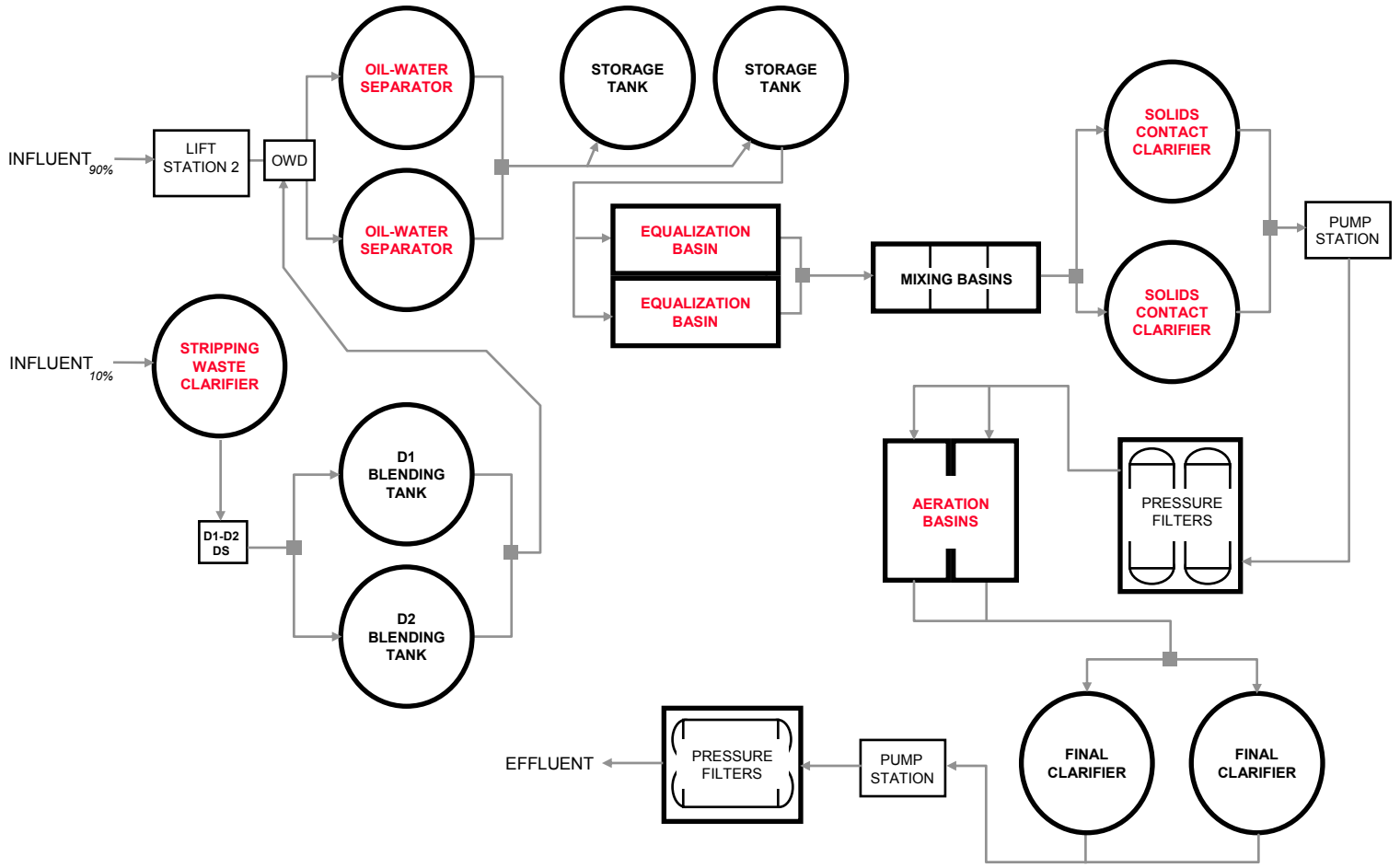
HEALTH RISK ASSESSMENT

Uniqueness of Investigation

- Distinctive Elements of Investigation
  - *Combined use of WATER8 and ISC-ST3*
  - *Literature directed to specific applications*
  - *Coupled model compared to MAAC*
  - *Literature limited to single emission sources*
  - *Literature focused at municipal wastewater treatment*
  - *Detail and size of periodic canister data*
  - *Investigation of three remote optical paths*
  - *Multiple retroreflectors along optical path*
  - *Evaluation of chemical depainting agents*
  - *Coupled model used in risk assessment*
  - *Completeness and comparative analysis*

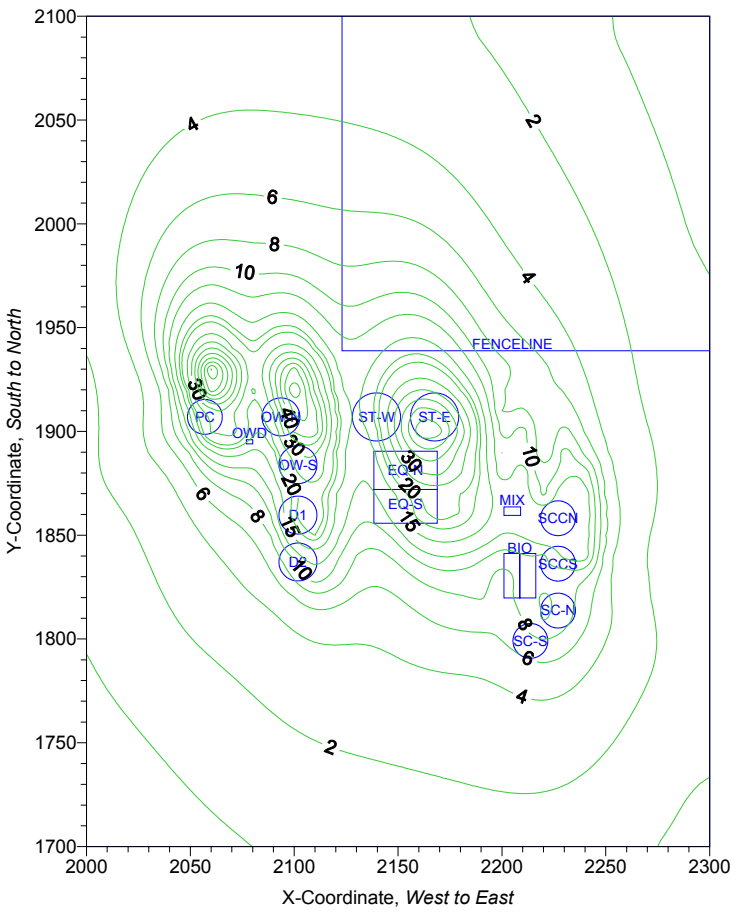
IWTP PROCESS FLOW DIAGRAM

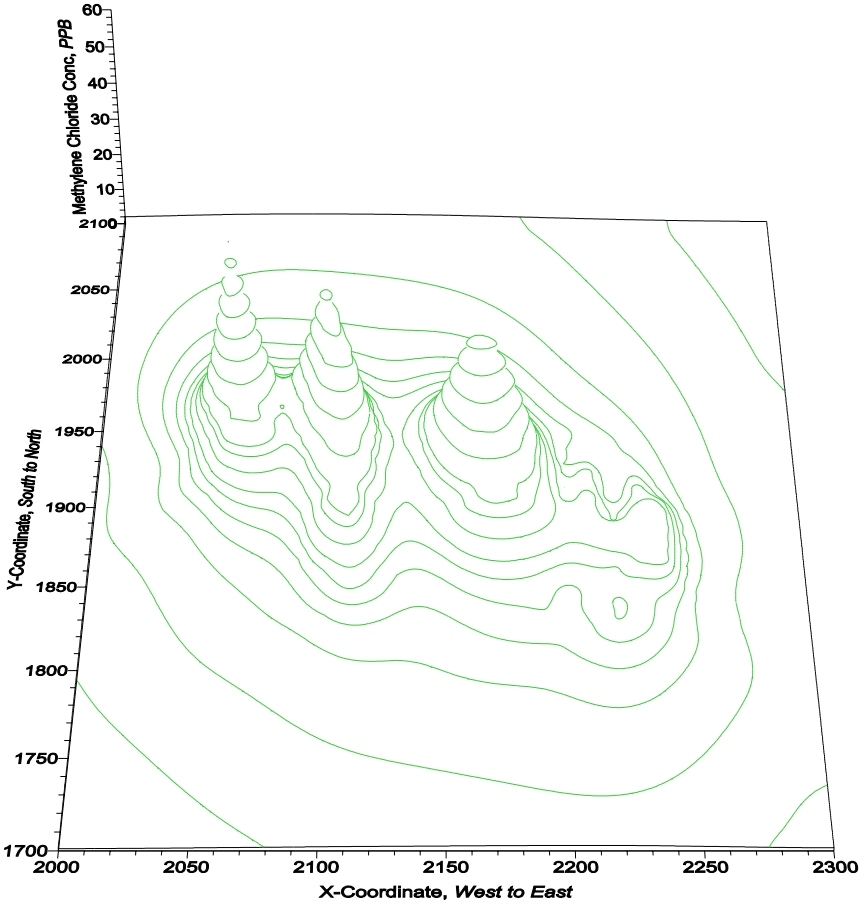
Primary, Secondary, & Tertiary Treatment



COUPLED MODEL OUTPUT

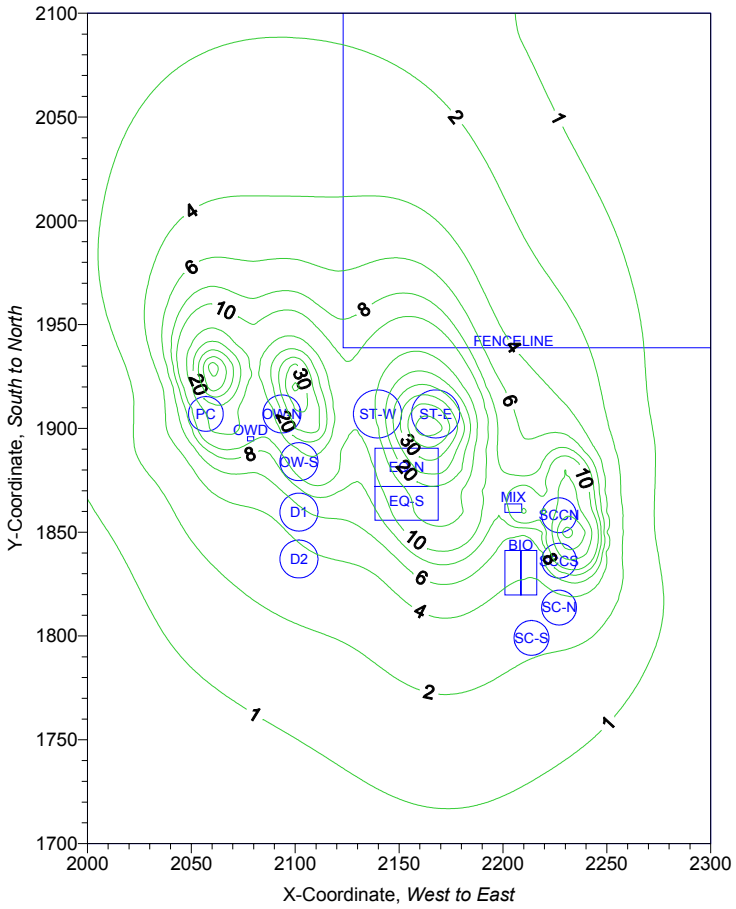
Maximum Methylene Chloride Concentrations, PPB

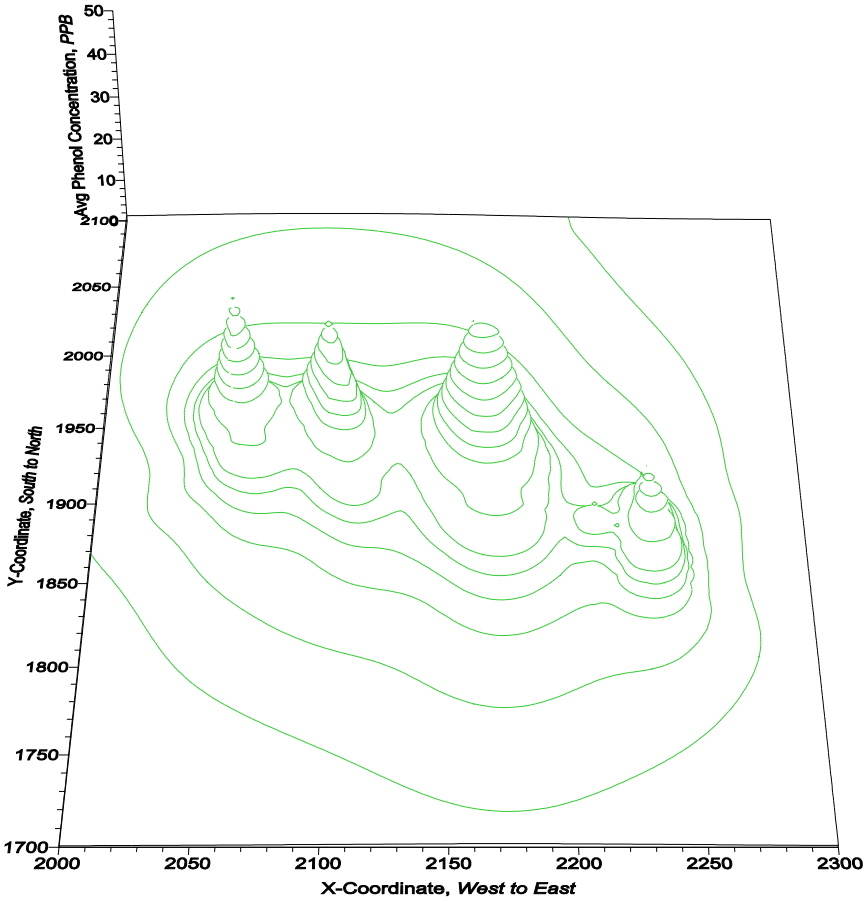




COUPLED MODEL OUTPUT

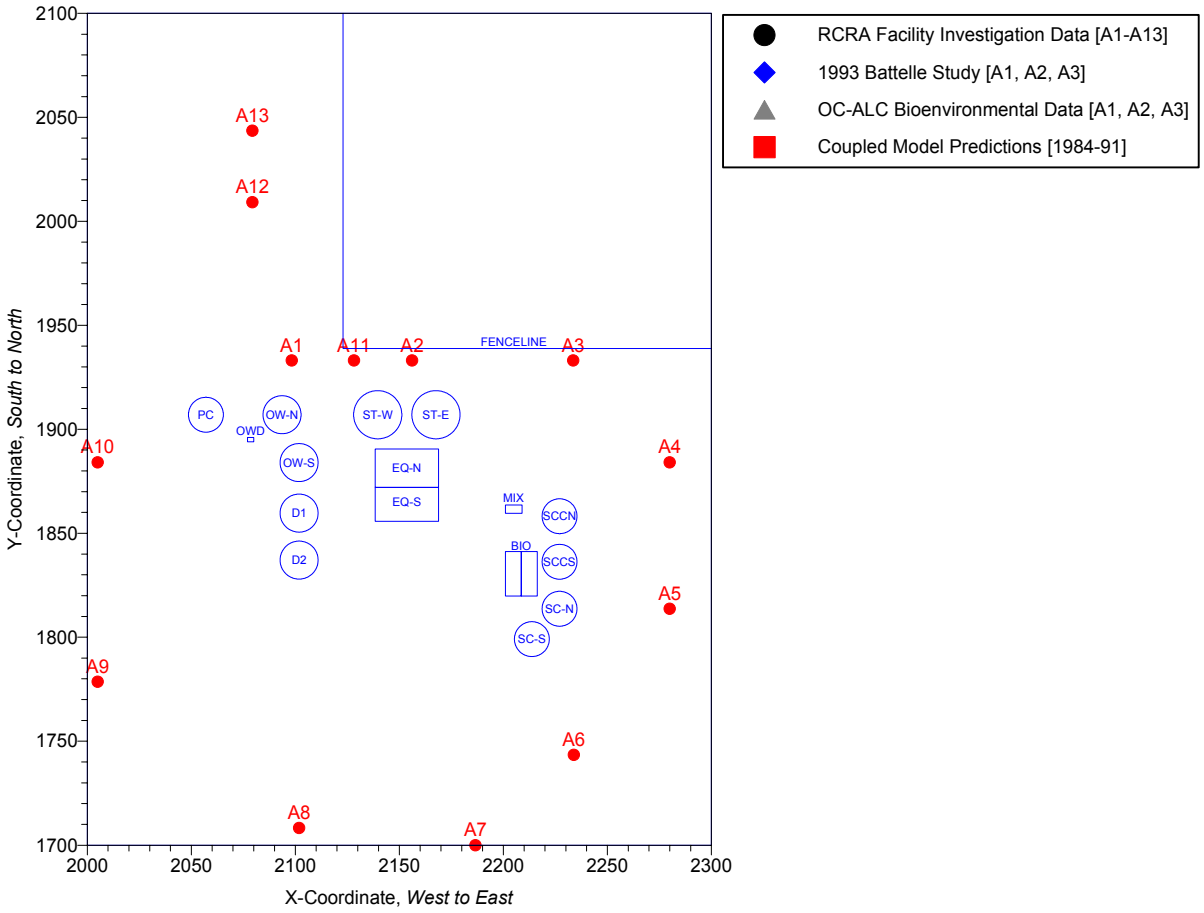
Maximum Phenol Concentrations, PPB





HEALTH RISK ASSESSMENT

Location of Periodic Canister Data



HEALTH RISK ASSESSMENT

Methylene Chloride and Phenol Exposures

- Task 4 involves Demonstration of Potential Uses of Coupled Model by conducting a Risk Assessment of Impact Region
  - *Computations will use coupled model concentration predictions in risk assessment tasking*
  - *Efforts are focused on housing community & IWTP personnel*
  - *Efforts will attempt to quantify risks to target population groups*
    - *Determine equivalent human dose [based on IRIS program]*
    - *Maximum chemical dose for individuals in target population*
    - *Maximum risk for individuals in target population*
    - *Excess number of cases of cancer in focus group*
    - *Average number of cancer cases generated per year*
    - *Loss of life expectancy for target population*
    - *Comparisons to 1993 ATSDR Study & 1996 Statistical Review*

COUPLED MODEL OUTPUT

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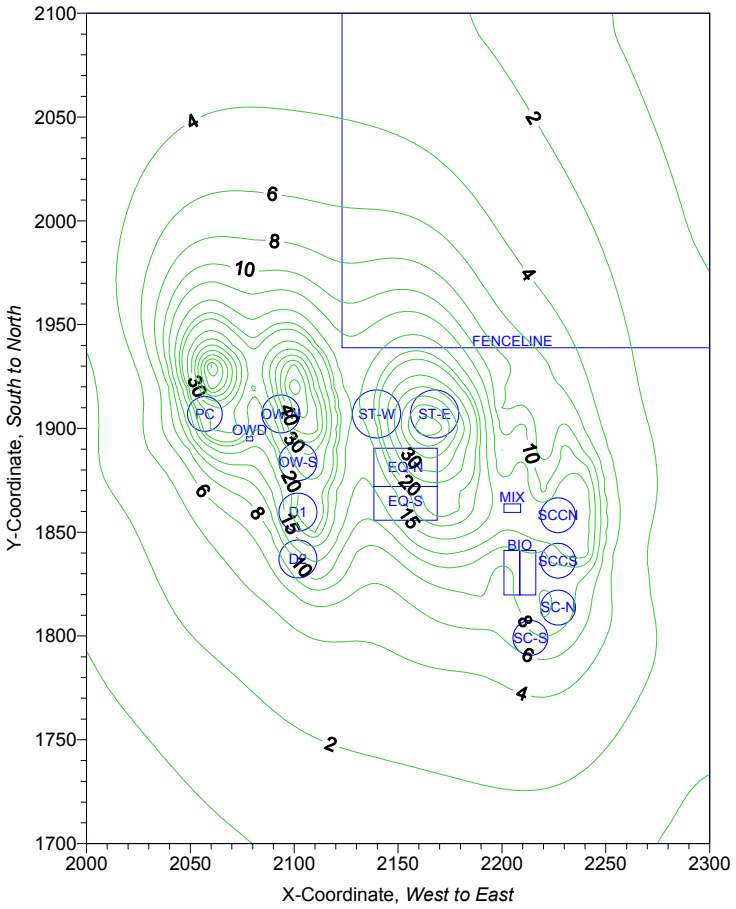
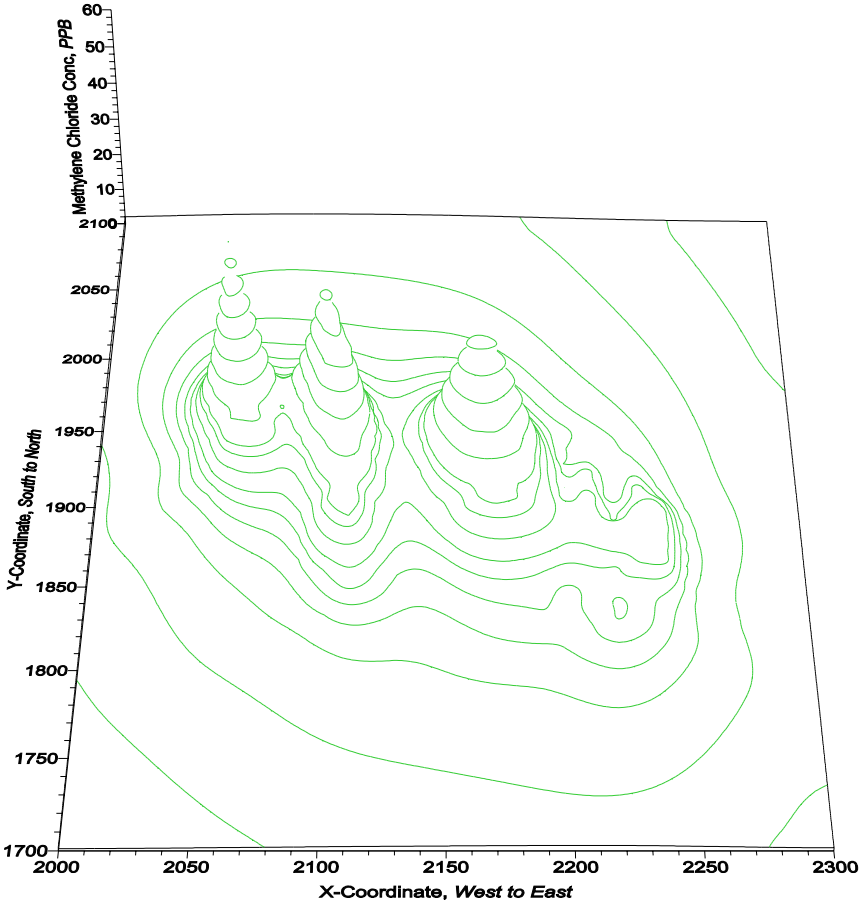
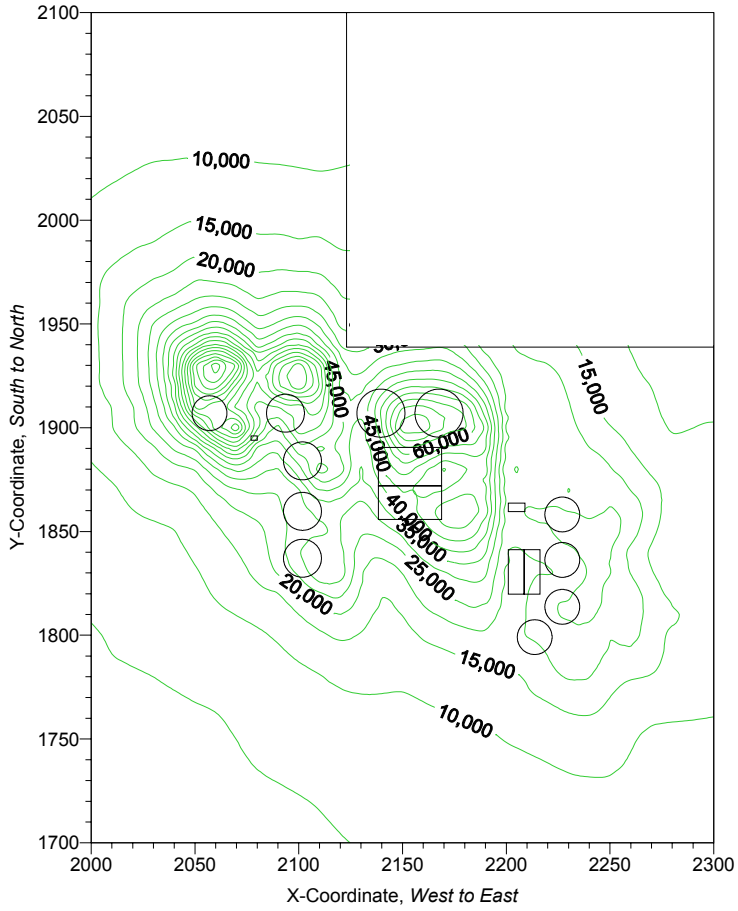
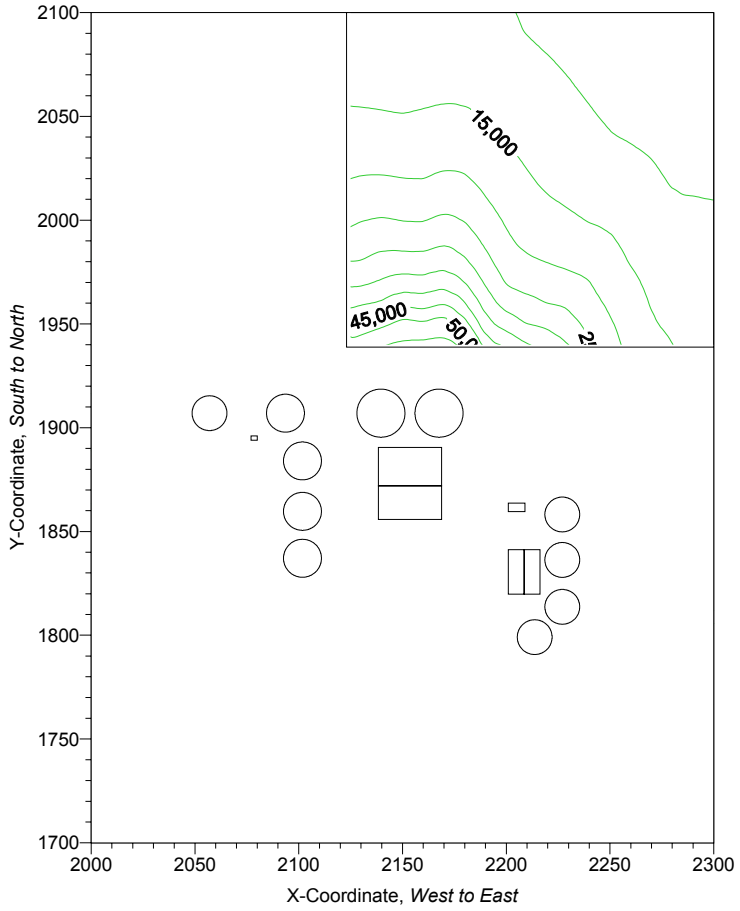




RISK ASSESSMENT OUTPUT

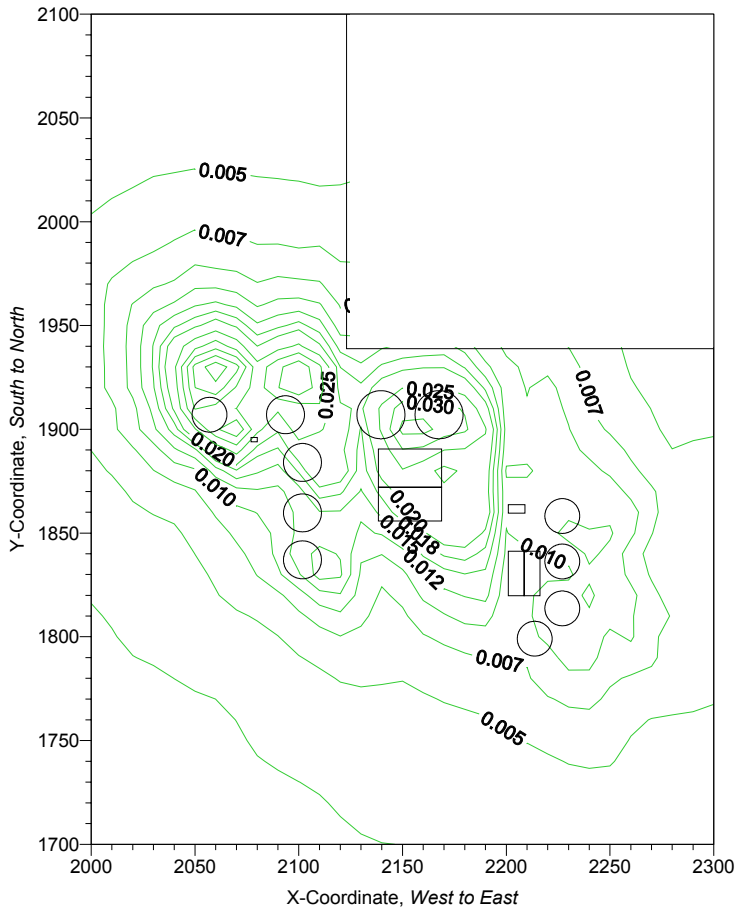
Equivalent Human Dose for Methylene Chloride Exposures

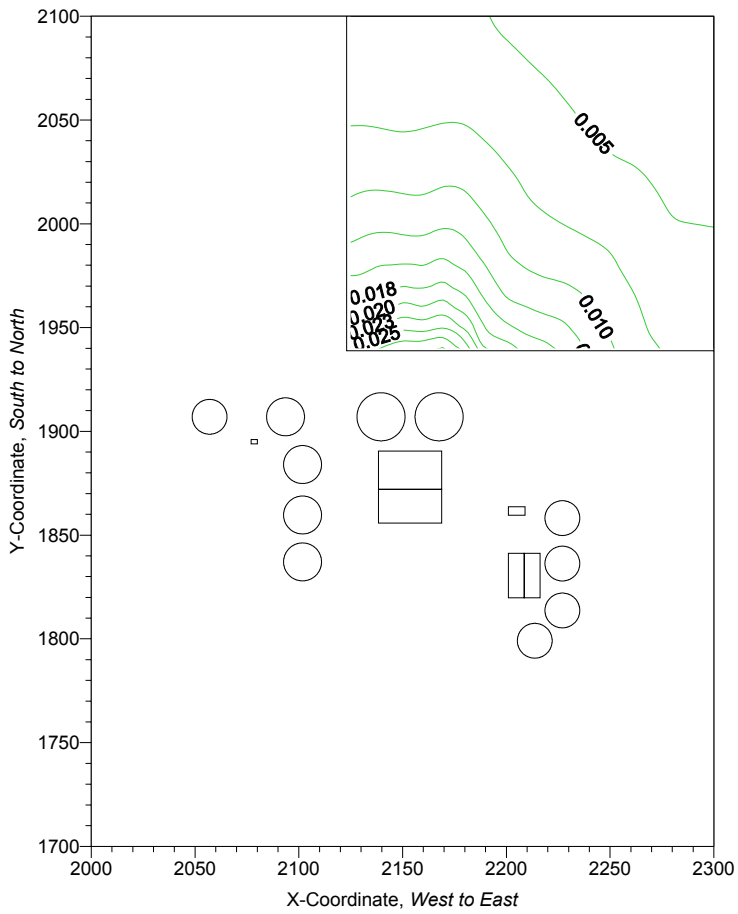




RISK ASSESSMENT OUTPUT

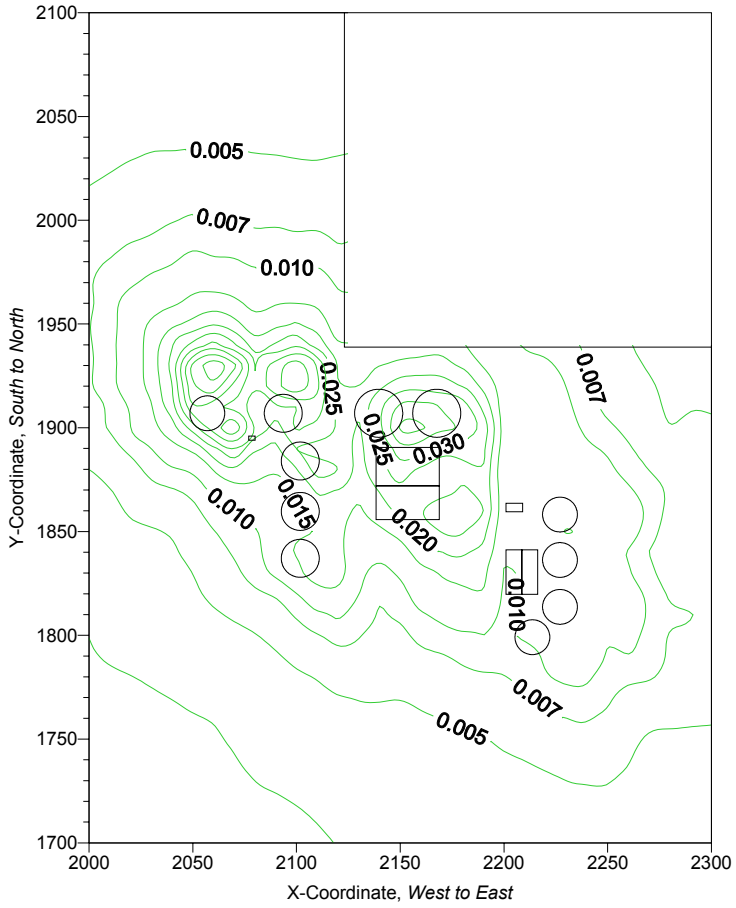
Maximum Individual Risk for Methylene Chloride Exposures

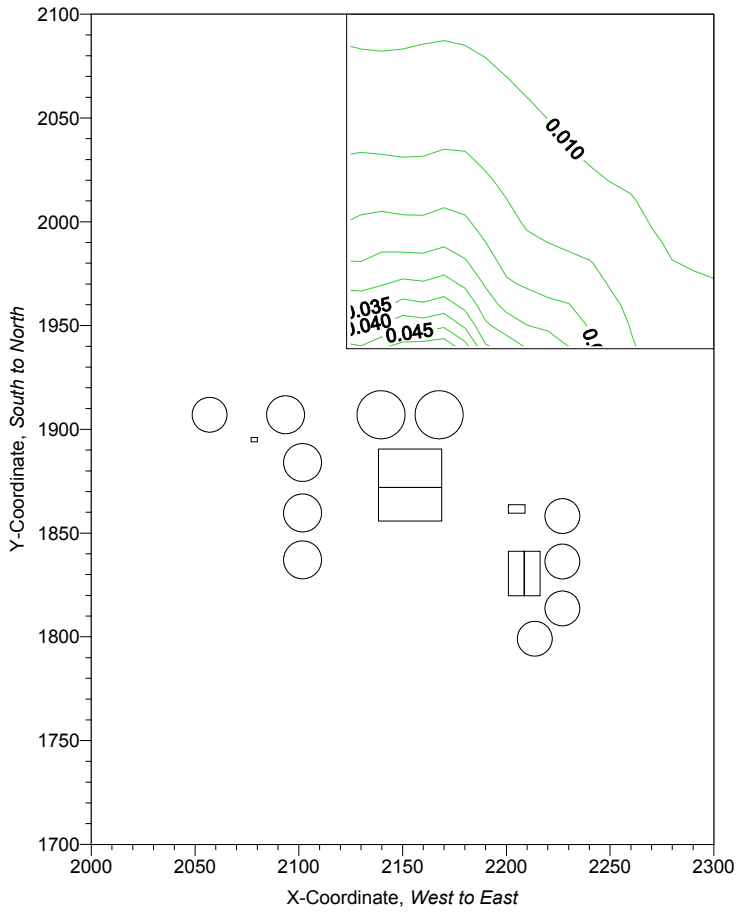




RISK ASSESSMENT OUTPUT

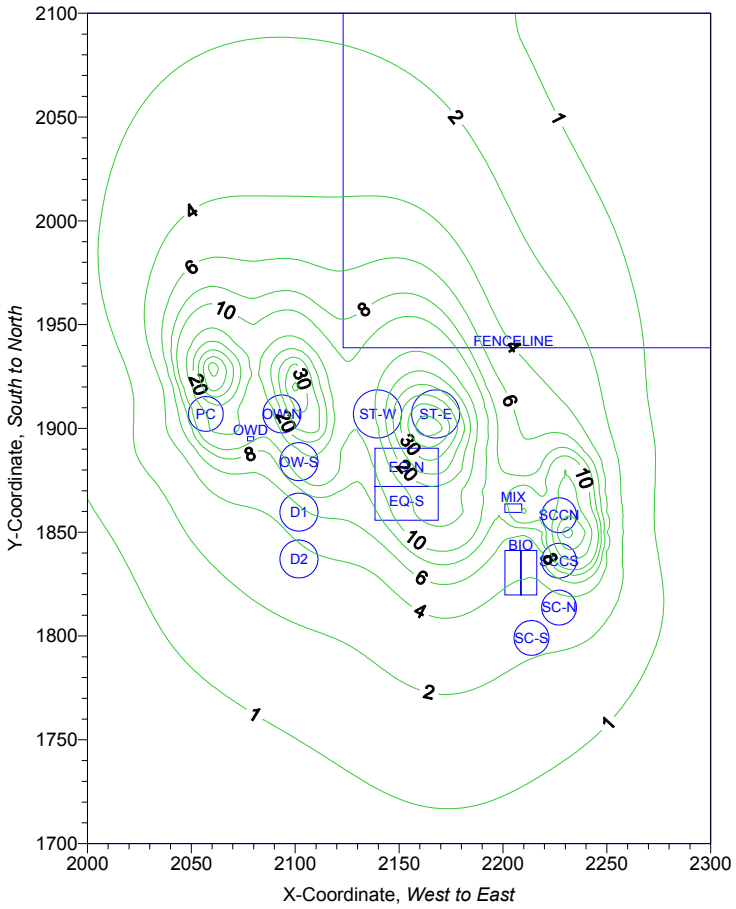
Excess Cancer Cases for Methylene Chloride Exposures

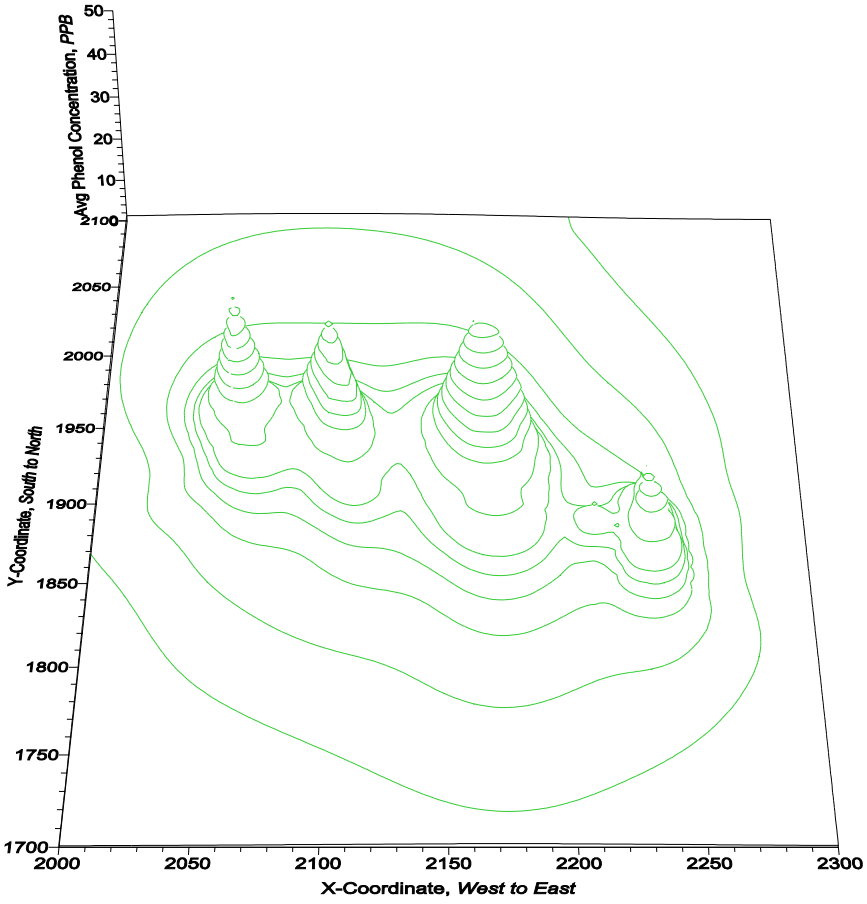




COUPLED MODEL OUTPUT

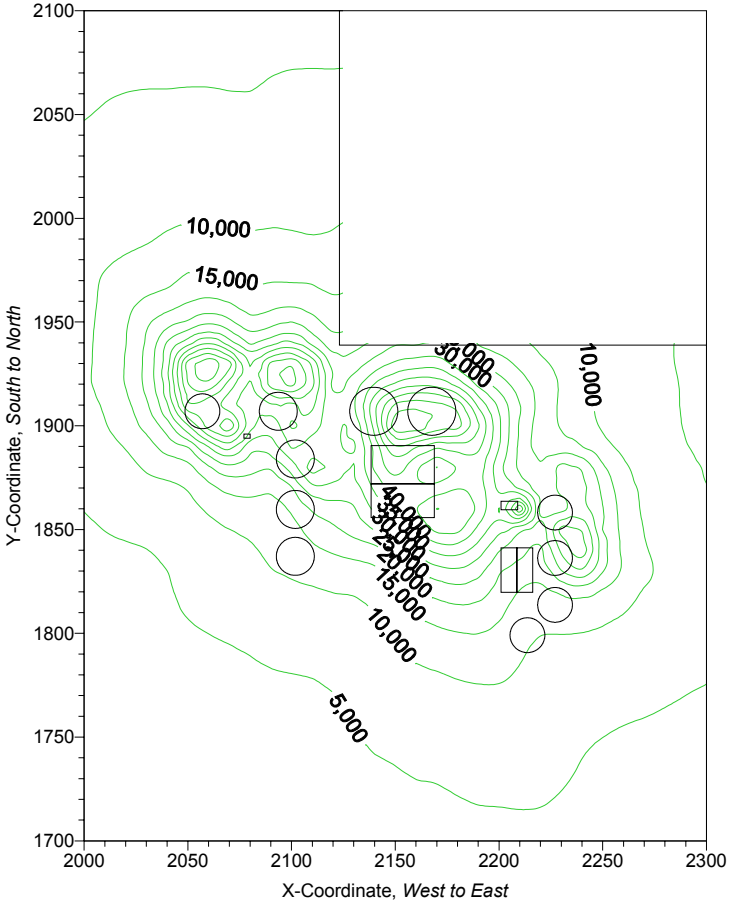
Maximum Phenol Concentrations, PPB

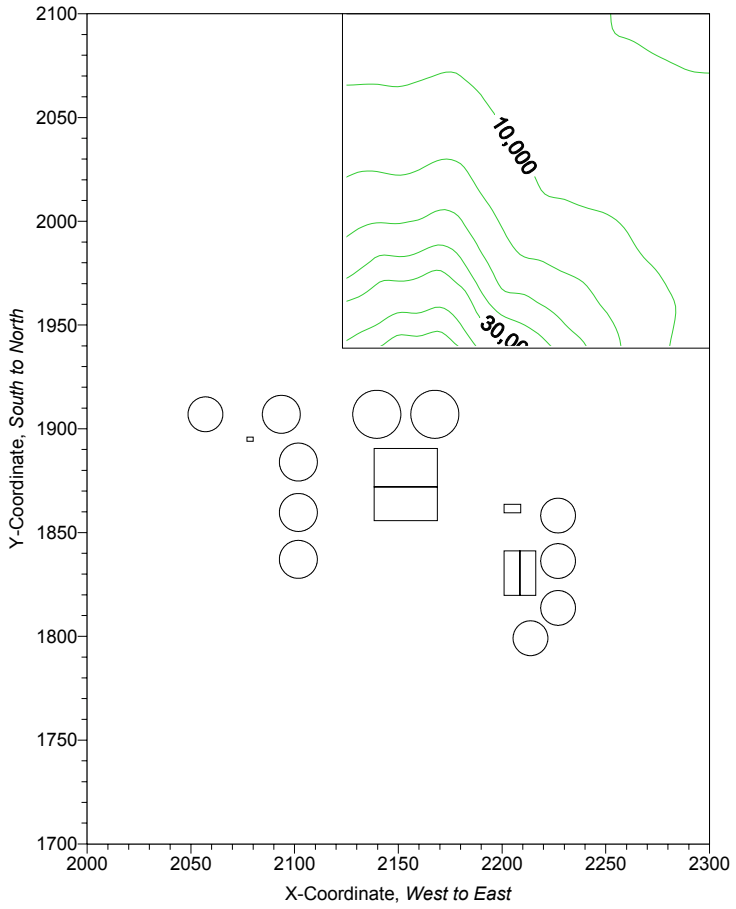




RISK ASSESSMENT OUTPUT

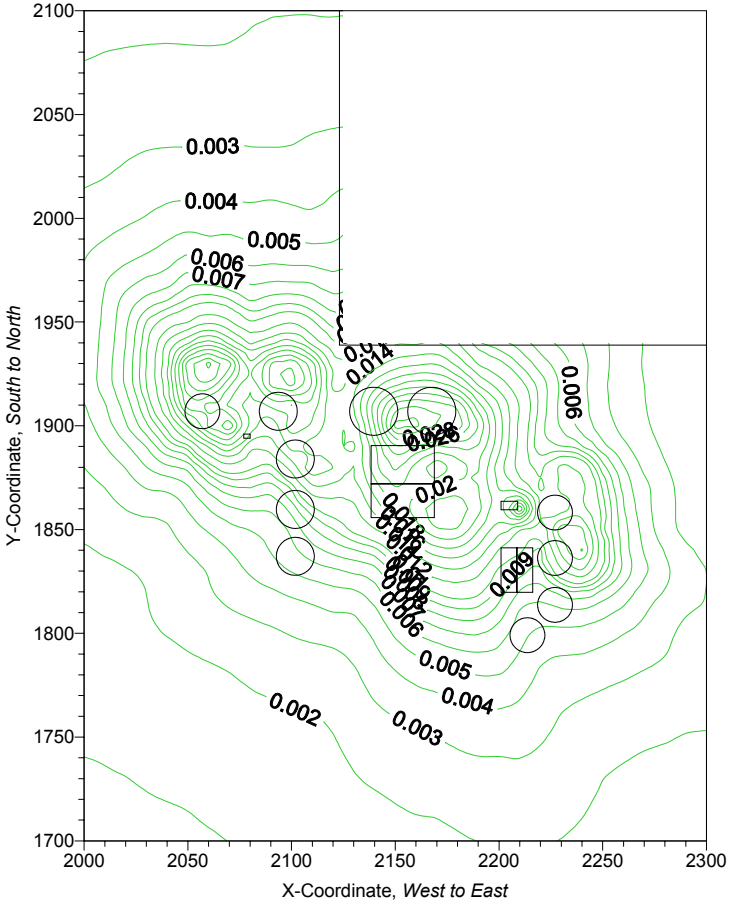
Equivalent Human Dose for Phenol Exposures

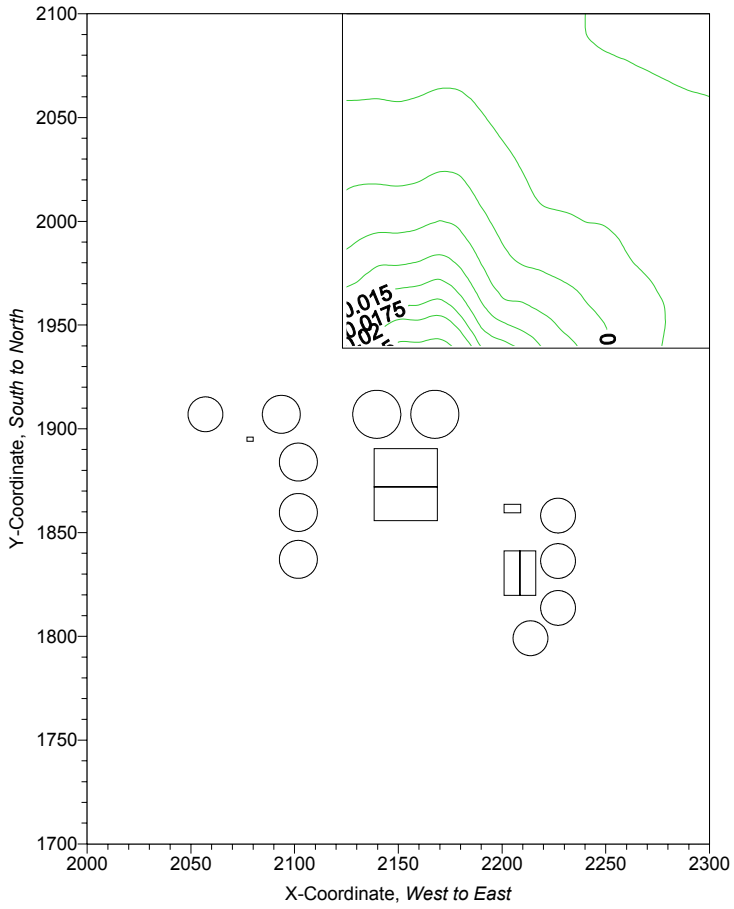




RISK ASSESSMENT OUTPUT

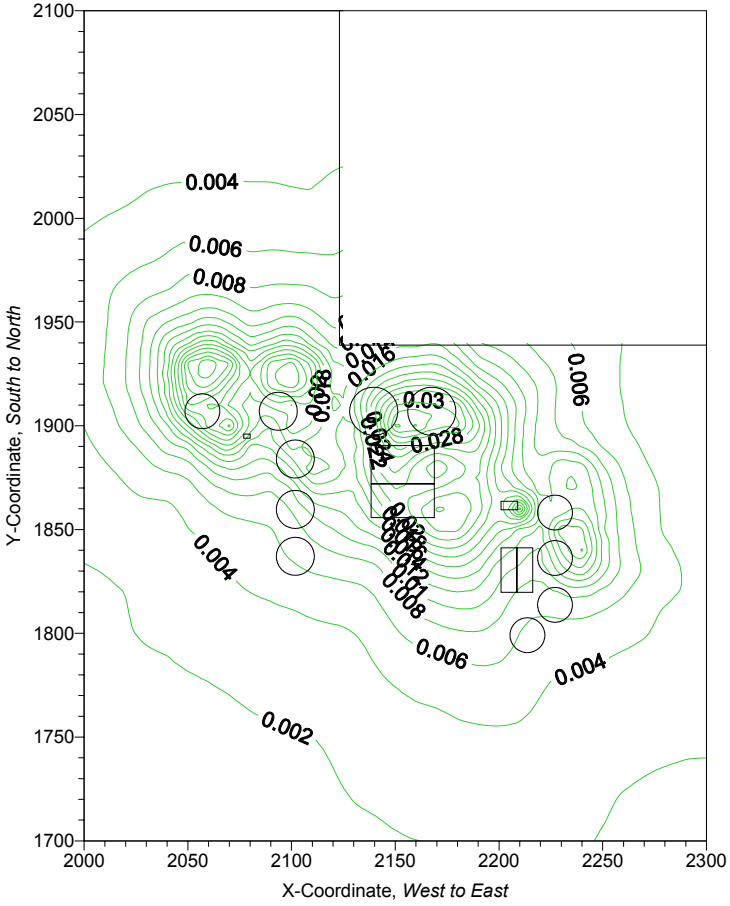
Maximum Individual Risk for Phenol Exposures

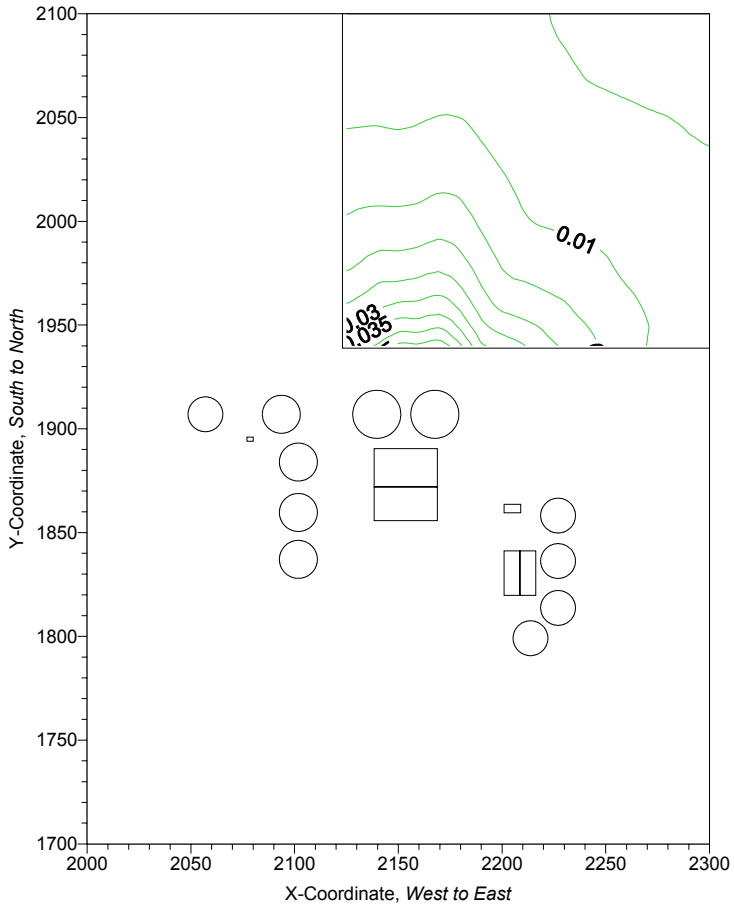




RISK ASSESSMENT OUTPUT

Excess Cancer Cases for Phenol Exposures





HEALTH RISK ASSESSMENT

Summary & Conclusions

- Coupled Model can be used to conduct Risk Assessment
- Inhalation Exposures well under LOAEL concentrations
- Cancer Cases well under County & State Averages
  - *Average 16 and 19 per year, respectively*
- Loss of Life Expectancy matter of hours
  - *Smoking shortens life by 6.2 years*
- Neither Chemicals pose Health Risk to Population Groups
  - *Chemicals have been replaced with EA chemical strippers*
  - *Incorporated operational changes to minimize exposures*
- Supported by two ATSDR Investigations in 1993 & 1996
- Similar Results from Oklahoma State University Study
  - *Using better models and additional canister data*

HEALTH RISK ASSESSMENT AT AN INDUSTRIAL WASTEWATER TREATMENT FACILITY

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