EVS MODEL PARAMETERS

1.0 INTRODUCTION

3-Dimensional presentations (4DIMs) of the chemical data collected at the Site were completed using C Tech's EVS/MVS (EVS) software package. The following presents the conventions and assumptions used to create the 4DIMs.

2.0 CONVENTIONS AND ASSUMPTIONS

2.1 SAMPLE SET

The visualizations use data collected from the OCC Site. For groundwater data, the most recent data points collected from each location and depth interval were used for the visualizations, provided that the last sample was taken between January 1, 2004 and October 11, 2013. Results are grouped by sample matrix into groundwater data sets. Only locations with easting (x), northing (y), and elevation (z) data were used in the visualizations.

2.2 MODEL DOMAIN

EVS allows for the model grid resolution to be specified by the user (i.e., set the number of nodes for the model grid). The resolutions were 136 (20 ft spacing), 181 (20 ft spacing), and 193 (1.25 ft spacing) for the x, y, and z dimensions, respectively. These values were used to be consistent with the groundwater flow model, and were used as the model domain for all of the EVS models.

2.3 KRIGING PARAMETERS

EVS uses a standard kriging method with either a convex or rectilinear hull. A convex hull method assigns node values only to the volume inside the perimeter of the dataset (plus a fractional volume indicated by the users). A rectilinear method assigns a rectangular region around the dataset, potentially to areas not confined by the polygon surrounding the dataset. The attached visualizations use a rectilinear hull to be consistent with the groundwater flow model domain.

EVS allows for the kriging grid resolution to be specified by the user (i.e., set the number of nodes for the kriging). The resolutions were 136 (20 ft spacing), 181 (20 ft spacing), and 193 (1.25 ft spacing) for the x, y, and z dimensions, respectively.

EVS also allows for adaptive gridding. This allows EVS to skew the kriging grid so that it is not comprised of homogeneous boxes which allows more data points to coincide with grid nodes. Adaptive gridding often provides a visualization which honors the data points more so than without. The attached visualizations were created using adaptive gridding.

When more than one data point is available for the same grid node, EVS allows the user to take the average of the values or to favor the maximum value. The current visualizations favor the maximum value to provide for a more conservative estimate of plume boundaries. Models depicting the differences between these two options were also provided in January 2006 and showed only subtle differences.

The user can also select the maximum distance and number of data points to compare when generating values for grid nodes. Selecting greater points and distances will tend to generate smoother contour lines (especially where sampling is sparse) but exponentially increases the time needed to calculate node values.

The existing datasets include a region of several thousand feet horizontally and about 200 feet vertically, with roughly 1000 to 2000 data points for the main chemicals of concern. Some areas have a very dense sampling network where others less so. The model defaults establish a reach of 3000 feet and 20 points, meaning each grid node value is estimated using the closest 20 points that are less than 3000 feet away. Since 3000 feet is halfway across the site, the number of points becomes the limiting factor for the grid node value estimates. Typically the visualizations are reviewed using the closest 20 points and finalized using the closest 100 points. The attached visualizations were produced using the closest 100 points within 6000 feet of the grid node.

EVS allows for either log or linear kriging. Logorithmic kriging is often preferable for some types of groundwater chemistry data, especially for data that spans many orders of magnitude. The current visualizations use linear kriging for pH, density, and temperature, all other chemistry visualizations are done using logarithmic kriging.

Implementation of the kriging process involves the use of a variogram to describe the variance in the data. A variogram is an X-Y plot of the average squared difference between a pair of data values (effectively the variance) and the distance versus the distance between the pairs. On the plot, a line (also called a function or model) that best

fits the data is added, which can be defined by various parameters (sill, range, nugget), which are calculated automatically by the software. Sill is the parameter describing where the variogram function becomes parallel with the X-axis. Range is the distance (X value) where the variogram function becomes parallel with the X-axis. Nugget is the variogram when the distance (X) is zero, and represents variances estimated at the sample location. By default EVS uses a nugget of zero, which forces the interpolation to match the data exactly at the locations where samples exist. All variogram parameter values are calculated by the geostatistical module incorporated into EVS/MVS.

2.4 ANISOTROPY RATIO

The anisotropy ratio represents the degree to which properties favor one direction over another (horizontal to vertical). An anisotropy ratio of 1 represents a property with no direction favor. An anisotropy ratio of 10 indicates a property that favors the horizontal direction 10 times to the vertical. Large anisotropy ratios tend to produce thin, lenticular features in models. EPA/Ecology requested that an anisotropy ratio of 20 be used for the chemical visualizations in this report, in place of the default value of 10.

2.5 NON-DETECT VALUES

EPA/Ecology requested that all non-detect results be assigned a value of half the detection limit for that sample.

2.6 POST CLIP MINIMUM AND MAXIMUM VALUES

The user can also specify the values to ignore when creating a grid node, large or small. This reduces the influence of anomalous readings (high and low) but will tend to result in models that do not honor all of the data points. The current visualizations do not clip the minimum values and the maximum clip value was set to 1,000,000,000 ppb so that all of the data was honored.

3.0 SUMMARY

The 4DIM presentations have been created using parameters and assumptions consistent with standard practices, and were developed in consultation with agency personnel and representatives.