Drawing technology reduces conversion time on ammonia plant drawings

by Mike Bethune and Ed Aisenbrey

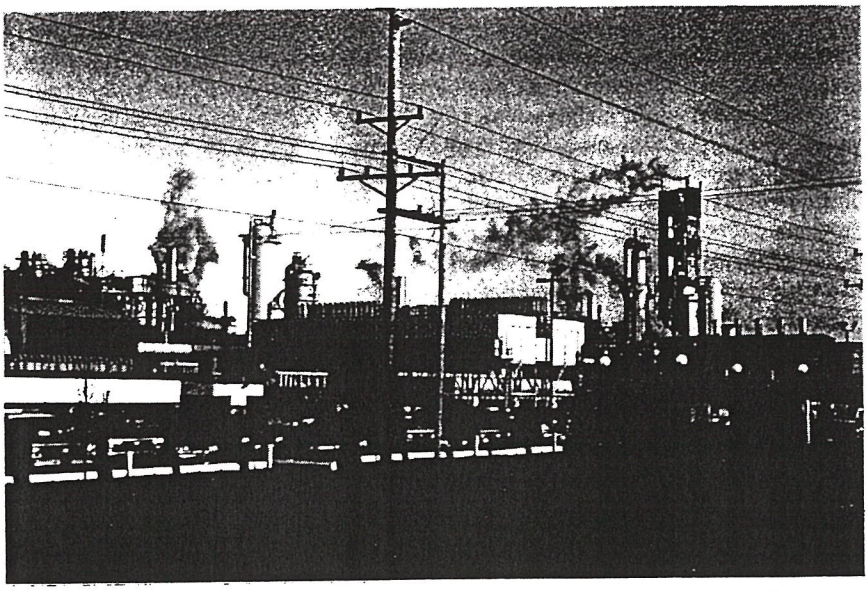
The Kenai, Alaska complex of the Unocal Chemicals and Minerals Division of Unocal Corporation is among the largest chemical producer in Alaska and the largest ammonia producers in North America. Recent corporate policy changes dictated that a hazardous operations (HAZOP) analysis be performed at the plant. The Kenai plant was originally designed using paper drawings, in the mid and late 1960's, and many of the drawings are out of date. It was decided that, with the drawings having to be virtually redone anyway, they may as well be converted to computer aided design (CAD) at the same time.

It soon became clear that the process of entering each of the approximately 130 paper drawings, some of which are up to 15 feet long, and creating associated equipment lists would take a large amount of time on a conventional CAD system. Upon further examination, Unocal discovered the existence of a new generation of piping design software which keeps track of piping connectivity with other lines, equipment and drawings. Important non-graphic data such as material of construction and design pressures and temperatures are also accounted.

With the project about half completed, it is apparent that the use of one of these packages, AutoPLANT from EDA Associates, Berkeley, California, is going to cut conversion time considerably compared to that needed with conventional CAD. Substantial additional savings are expected to be achieved during the HAZOP analysis because the non-graphic data will be accessible merely by pointing to the relevant entity on the drawing.

The basic idea of the HAZOP analysis is to apply a deviation matrix to each entity in the plant and examine potential off specification conditions such as high and low temperature, high and low pressure, vacuum, etc. The next step is to examine the consequences of failure and to determine whether the existing safeguards provide adequate protection.

A considerable amount of non-graphic data is required because accurate information on the specification of each piece of equipment such as its operating range, design limits, material specifications, etc. is needed to perform the deviation analysis. After considering these requirements, Unocal engineers examined several piping design software packages and selected AutoPLANT because of its ability to automatically keep account of connectivity within the plant and to provide quick access to non-graphic data. Another feature which Unocal engineers liked about the package was its ability to be easily customized by anyone familiar with AutoCAD.



The Unocal Chemicals Division Ammonia and Urea facility, Unocal Corporation in Kenai, Alaska.

Unocal determined that the magnitude of the paper-to-CAD conversion project was too great to be handled with its present internal resources and enlisted PetroCAD. This firm was formed for the purpose of providing CAD and engineering services to the chemical and petrochemical industries.

Before beginning the Kenai project, a number of modifications were made to the basic package in order to tune it to the needs of the project. Changes were made to a number of graphic symbols, attributes and menus in order to adapt them to Unocal specifications. The non-graphic data fields were tailored to the needs of Unocal.

The settings database links non-graphic data including the material of construction and design pressure and temperature, which are stored in attribute blocks, with appropriate graphical block at each insertion in the drawing.

As the project began, the difference in working with the new software was immediately apparent. The attributes of various components used in the plant are entered using the custom attribute blocks during the drawing process. As the information is entered, it is automatically associated with the relevant graphic entitles.

Connectivity is another aspect of the drawing which can be safely ignored by the draftsperson. For example, if a heat exchanger is inserted and a 10-inch line is routed from it, the software automatically updates the exchanger's attribute block to indicate that the particular pipe is attached. This feature is a significant advance over earlier plant layout systems which are capable of storing textual information on individual drawing items, but require that most or all of the connectivity information be typed in by hand.

With the enhancements of the new system, the connectivity relationships are

automatically updated. Storing and maintaining the connectivity information automatically also improves accuracy. On a project of this magnitude, analysing and entering by hand all of the connective relationships involved, would have been a very time-consuming task.

Having non-graphic data stored in the drawing also saves a tremendous amount of time in generating reports. PetroCAD staffers are able to simply provide the desired query specification for the drawing and ask for a print-out of the equipment list, instrument index, etc. This is a major time-saving feature. Having the connectivity information in the database also makes it possible to generate a number of additional reports which could not easily be created by manual methods such as valve lists sorted by line number and valve size.

Once the drawings are complete, it will be possible to position the mouse on an entity of the drawing and all of the relevant attribute information on that entity will pop up in a window. The graphic look-up procedure also eliminates the danger of retrieving outdated information from paper files.

The process of converting the drawings to CAD is 50 percent complete. The project is far enough advanced to be judged a tentative success. At this point, it is estimated that the entire Unocal complex of six plants from main production process to the utility plants will be detailed in about 18 months by a crew of four. This compares to the 30 months or greater required using conventional drafting.

Finally, while it is still unclear at this time exactly how they will be utilized, the abililty to quickly generate reports in virtually any format on any plant component is present. This provides much greater drawing management potential than was experienced in the past along with less duplicate data entry.

** Mike Bethune is with PetroCAD Consulting, Inc. in Kenai, Alaska. Ed Aisenbrey is a design-draftsman with Unocal Chemicals & Minerals Division, Kenai, Alaska.*