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POLLUTION PREVENTION ELECTRONIC DESIGN  
GUIDELINE: A TOOL FOR IDENTIFYING  
POLLUTION PREVENTION IN FACILITY  
DESIGN

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# Pollution Prevention Electronic Design Guideline: A Tool for Identifying Pollution Prevention in Facility Design<sup>(a)</sup>

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Abstract--The Pacific Northwest Laboratory<sup>(b)</sup> has developed a tool to assist in incorporating pollution prevention opportunities into the design of federal facilities. The Pollution Prevention Environmental Design Guide for Engineers (*P2-EDGE*) was developed for the U.S. Department of Energy (prior to its release this summer it had been referred to as the P2 electronic design guideline). *P2-EDGE* contains a database of 267 opportunities intended to help a decisionmaker (designer, engineer, or project manager) evaluate the applicability and potential benefits of implementing pollution prevention in a particular project. The *P2-EDGE* database was derived from both DOE and non-DOE sources including pollution prevention literature, industrial design personnel, and federal, state, and DOE sources. A key feature of the tool is the integration of photos, illustrations, and documentation to provide easy access to technical information on specific waste minimization opportunities in design.

Historically, pollution prevention activities have focused on existing process waste streams. However, it is estimated that 70% of the cost over the life of a product is fixed by design (i.e., before the product is constructed or used) (1). In recognition of this pollution prevention opportunity, the U.S. Department of Energy (DOE), Waste Minimization Division (EM-334), is

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funding a project to incorporate pollution prevention into the design of new products, processes, and facilities across the complex. We are beginning the third year of leading this activity for DOE Headquarters (HQ). In 1993, this program funded the development of a training course *Orientation to Pollution Prevention for Facility Design*, and an associated Pollution Prevention Design Guideline (2); and in 1994, it funded the preparation of a Pollution Prevention Design Assessment (P2DA) Guidance Manual, and the design and development of a prototype pollution prevention Electronic Design Guideline. The focus of current work is on continued promotion and widespread use of these tools throughout the DOE complex.

This paper describes the software tool, the Pollution Prevention Environmental Design Guide for Engineers, *P2-EDGE*, formerly called the Pollution Prevention Electronic Design Guideline. The *P2-EDGE* software runs on a personal computer within the Microsoft Windows environment. *P2-EDGE* is used with the P2DA Guidance Manual on a project-by-project basis. The P2DA process is analogous to the Waste Minimization Assessment method established by the U.S. Environmental Protection Agency for existing process waste streams (3). The *P2-EDGE* software tool is introduced during the stage of the P2DA when design alternatives are being explored (after the anticipated waste streams have been quantified). As such, the *P2-EDGE* database is not exhaustive, and it is not computational (i.e., it does not compute the life cycle impacts of implementation). Its purpose is to raise awareness of existing technologies and design practices that can improve resource efficiency or decrease waste generation over the entire life of the project (construction, operations, and decommissioning), and to provide a template for the documentation. Because design is an iterative process, *P2-EDGE* is also intended to be revisited with each successive design stage.

## **OVERVIEW OF *P2-EDGE***

*P2-EDGE* is intended to be used by architects and engineers who will evaluate the technical merit of discipline-specific design opportunities. It provides information on 267 opportunities to incorporate pollution prevention features into design projects. After examining the opportunities, the user may produce a report that compiles any notes or responses made to the opportunities. The output is a text file that can be edited using a word processing program.

To use *P2-EDGE*, the designer first specifies information about the project, including the size and type of project and the applicable design

phase. The size of the project is characterized according to DOE Order 4700.1 (4), which uses the following definitions: Major System Acquisition (MSA), Major Project, Minor Project, Capital Equipment Not Related to Construction (CENRTC), General Plant Project, and Expense Project. The type of project includes modification and new construction. The design phase is also characterized according to DOE Order 4700.1 by the following categories: Engineering Study, Functional Design, Conceptual Design, Preliminary Design, Definitive Design, and Construction. The EDG uses this project information to filter and display only the applicable opportunities. For example, the opportunities applicable to a large project may not be relevant to a small project.

The organization of the EDG data base reflects the sixteen divisions identified by DOE Order 6430.1A, *General Design Criteria* (5). These divisions are based on the Construction Specifications Institute (CSI) Masterformat system, and are therefore organized similar to specifications developed on non-DOE design projects. The user designates which divisions are applicable to the project and assigns responsible individuals to examine the opportunities in each division for possible use in the project.

The main display for **P2-EDGE** (see Figure 1) provides information on pollution prevention opportunities. The user may display opportunities from any of the 16 divisions. Within each division, opportunities are further sorted by the hierarchy established in the Pollution Prevention Act of 1990 (6): source reduction (A); recycling (B); treatment (C); and disposal (D). These pollution prevention hierarchy categories are indicated by color-coded, tabbed folders that can be accessed by using the mouse to click on one of the tabs beneath the division title. The number of pollution prevention opportunities vary within the 16 divisions and pollution prevention hierarchies (most are contained in folder A, reflecting a priority on source reduction).

## USING P2-EDGE

**P2-EDGE** is quickly learned and easy to use. Using a mouse, the user clicks on objects displayed in the windows to make selections, navigate between windows, or sequence through information displayed on the screen. The functions located in the pull-down menus promote efficient use and customization of the tool, including the following features:

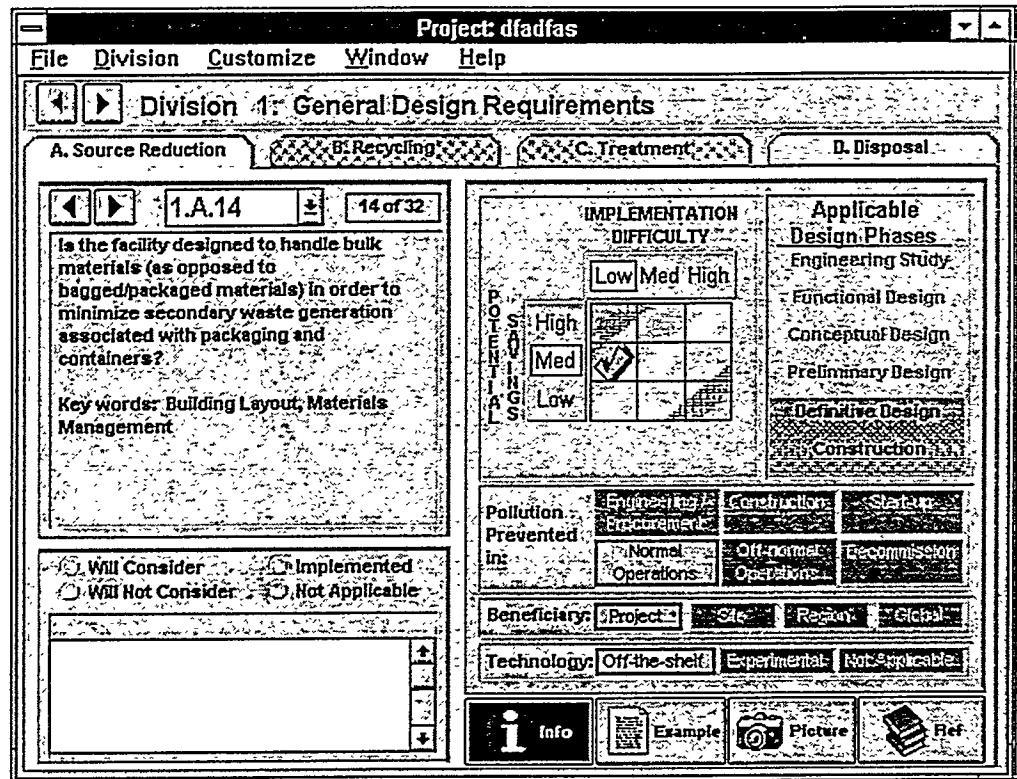


Figure 1. Pollution Prevention Opportunity Window

- create a new analysis, load or save an analysis
- produce a report
- navigate the 16 divisions
- search for key words in the *P2-EDGE* database
- filter out categories of information that are not of interest
- modify or add new data base records and maintain them in site-specific files
- context-sensitive help.

For each opportunity examined, the user indicates whether/how the opportunity will be considered for the current project. Additional remarks are requested and saved for later documentation. To help the user assess whether or not the opportunities listed are applicable to the current project, additional information is shown:

- *Implementation/Savings Matrix* portrays the relative difficulty of implementing the opportunity, as well as the potential savings. Most desirable is the combination of low implementation difficulty and high savings. Least desirable is high implementation difficulty and low potential savings. The position of the check in the matrix indicates the situation for the displayed

opportunity relative to the other opportunities in the database. Because all opportunities in the database are pollution prevention techniques or features, even the least desirable position deserves consideration. Further explanation and tailoring of this matrix to local conditions is available from a more detailed worksheet that displays the underlying rationale.

- ***Applicable Design Phases*** shows the time period (phases) during which the opportunity should be implemented. Six phases are defined: Engineering Study, Functional Design, Conceptual Design, Definitive Design, Procurement, and Construction. For example, design details such as purchasing building materials of recycled content would not need to be considered until the Definitive Design phase, whereas opportunities on the systems level, such as in-process recycling, would need to be considered during earlier stages of design. In general, the benefit will be greater if the opportunity is implemented in the earliest phase identified within the window of opportunity.
- ***Pollution Prevented in*** shows the life cycle phase in which pollution prevention effects are realized. Life cycle phases are Engineering/Procurement, Construction, Start Up, Normal Operations, Off-Normal Operations, and Decommissioning. Some of the equipment selection suggestions will prevent pollution during operation of the facility, but others-like recommendations to use materials to facilitate recycling-- will not realize a benefit until the facility is decommissioned.
- ***Beneficiary*** indicates who will realize the benefits. For most opportunities, one group tends to receive particular benefit. The groups identified in the EDG include Project (typically benefitted by process improvements); Site (typically benefitted by applying pollution prevention concepts to utilities, e.g., water, electricity, and energy); Region (typically benefitted by recycled content products); and Global (typically associated with ozone depleters).
- ***Technology Availability*** identifies the state of the technology: Off-the-Shelf, Experimental, or Not Applicable.

In addition, examples or references are available to help the user assess whether or not opportunities are applicable and appropriate to the current project. To read about brief examples, case studies or other applicable information, the user clicks on the Example button. To view a photograph, diagram, or illustration, the user clicks on the Picture button. Applicable references are available by clicking on the References button. References include the applicable paragraph from DOE Order 6430.1A, if the opportunity is required by DOE Order, and other relevant references.

## PLANS FOR DEPLOYMENT

*P2-EDGE* is currently being deployed across the DOE complex. It will eventually become part of the collection of resources and tools that are being put in place, namely, the *Orientation to Pollution Prevention for Facility Design* training course and the P2DA Guidance Manual. The P2DA Guidance Manual and *P2-EDGE* have been tested on eight design projects of various sizes and design stages at different DOE sites. Results of these trial case studies are described elsewhere.<sup>(a)</sup>

Extending the use of the EDG to the broader context of military or commercial/industrial applications is an attractive option that is under consideration. The database contains general examples that apply to military and commercial facility design, but much of the context and terminology are DOE-specific. Results of a focus group (held in November 1994) with architectural and industrial firms suggest that a more comprehensive database and commercially relevant terminology will be required, as well as the capability for users to add their own data to the *P2-EDGE* database. Similar customization will undoubtedly be required for a military version of the *P2-EDGE*.

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