United States Environmental Protection Agency

Office of Water
4301

EPA-820-R-95-011
July 1995

EPA

Pollution Prevention Assessment and Implementation at a Pulp and Paper Mill in the Pacific Northwest

Summary Report

A Demonstration Project of the Industrial Pollution Prevention Project (IP3)

POLLUTION PREVENTION ASSESSMENT AND IMPLEMENTATION AT A PULP AND PAPER MILL

Introduction

The Industrial Pollution Prevention Project (IP3) conducted one of its four regional demonstration projects in the Pacific Northwest at a pulp and paper mill. The purpose of this demonstration project was to (1) demonstrate pollution prevention opportunity assessment and implementation at a specific pulp and paper mill in Tacoma, Washington; (2) develop a model pollution prevention (P2) plan for use by other similar mills; and (3) provide a bibliography of publications related to pollution prevention for the pulp and paper industry. The project also sought to demonstrate the use of the model P2 plan in permit writing and in the enforcement settlement process in other locations in the Pacific Northwest.

The demonstration began in late 1991 and involved conducting a detailed pollution prevention opportunity assessment and developing a P2 implementation plan to be implemented by the facility. The site for the demonstration was the Simpson Tacoma Kraft Company in Tacoma, Washington. In addition to the P2 assessment and implementation plan developed specifically for the Simpson Tacoma Kraft Company, a model P2 plan was also developed to be used with other pulp and paper facilities in developing their own P2 plans.

The pulp and paper industry was selected for this Pacific Northwest regional demonstration because of the number of pulp and paper facilities in the region and their contribution to multi-media pollution loads and waste streams. U.S. EPA's Region 10 Office (in Seattle) sought to gain from the demonstration ideas on integrating pollution prevention into their efforts with other pulp and paper facilities throughout the region.

The pulp and paper industry was selected also because effluent guidelines for that industry were being developed by U.S. EPA and because of the pulp and paper industry's involvement in other major environmental programs administered by U.S. EPA.

The Simpson Tacoma Assessment and Implementation Plan

The Simpson Tacoma Kraft Company operates a kraft pulp and paper mill in Tacoma, Washington producing natural and bleached pulp, kraft paper, and bleached kraft paper used primarily for white and white-top liner board, natural bags, sacks, and similar food and industrial grade packaging products. The fiber supply is principally Douglas fir, alder, and western hemlock chips purchased from captive lumber yards and sawmills and on the open market. Wood chips are received by barge, rail, and truck and stored on site.

Production capacity is about 1,200 air-dried tons per day of pulp and paper products; as such, the mill is classified as a medium-to-large operation. Depending on market conditions, about one-third of the pulp produced is bleached. Simpson Tacoma has also installed a hydropulper for processing recycled newspapers and double-lined kraft cuttings. The hydropulper has a capacity of 100 tons per day.

The U.S. EPA in cooperation with the Simpson Tacoma Kraft Company and the Washington State Department of Ecology conducted a study of the opportunities for pollution prevention at the company's Tacoma mill. The assessment identified and evaluated feasible process alternatives for implementation by reviewing major process areas and equipment at the mill using on-site observations, interviewing plant personnel, and evaluating emission and discharge estimates from the Toxics Release Inventory (TRI) data.

Table 1 summarizes the P2 alternatives identified as feasible from the opportunity assessment. The cost estimates for these projects range from several thousand dollars to several million dollars. Information presented in the table includes description of the alternative, estimated pollution reduction benefits, approximate cost, and suggested priority for implementation.

Recommendations were made to Simpson Tacoma to develop an ongoing P2 program and implement near-term and long-term process modifications to attain P2 benefits.

The recommended near-term options, for implementation within 1 to 5 years, included:

(an asterisk (*) denotes the highest priority recommendations)

- fugitive dust control for chip piles *
- stormwater control related to chip piles
- indirect heat exchangers on batch digesters *
- utilization of boiler ashes and slaker grits *
- exhaust smelt tank vents to No.7 power boiler
- expansion of the non-condensible gas system *
- black liquor spill prevention and recovery *
- improved water conservation and reuse for the paper machines and pulp dryers *
- improved steam condensate recovery for the paper machines and pulp dryers
- ammonia discharge control
- save-alls on pulp dryers
- replacement of PCB-containing transformers *
- asbestos removal *
- increased bulk and semi-bulk purchases to eliminate drums *
- minimization of miscellaneous hazardous wastes *
- improved steam condensate recovery throughout the mill
- improved water conservation and reuse throughout the mill *

The recommended long-term options, for implementation within 5 to 10 years, included:

- expansion of mill capacity with addition of secondary fiber
- replacement of existing batch digester kraft capacity with addition of secondary fiber
- replacement of No.2 and No.3 brownstock washers
- upgrading or replacement of No.3 recovery boiler
- new MCC (modified continuous cooking) digester for bleached stock
- addition of oxygen delignification
- operation of bleach plant at 100% chlorine dioxide substitution
- installation of chip thickness screens
- steam stripping of foul condensates or incineration in power boiler.

The P2 assessment and implementation plan for Simpson Tacoma also points out and discusses the importance of and how to establish:

- management commitment to P2
- having a corporate framework for P2 (e.g., a P2 Committee)
- incorporation of P2 within the company's planning processes (capital appropriation and budgeting) as well as operating plans
- an environmental auditing program
- a tracking system for P2 successes
- P2 awareness among company employees

Results

Simpson Tacoma has already implemented many P2 measures and is in the active process of implementing many more. These include 11 of the recommended near-term options and 4 of the recommended long-term options. The investment cost for all the measures implemented to date totals over $100 million. Most of the major expenditures have been for process or utility system upgrades that provide significant P2 benefits as well as product quality and resource utilization benefits. For example, installation of the No.4 brownstock washer and associated screening and deknotting systems and the new bleach plant resulted in substantial reduction in bleach plant chemical consumption and the amounts of chlorinated compounds generated, while yielding bleached pulp of higher quality suitable for a wider range of markets than would otherwise have been possible. Installation of the No.7 power boiler resulted in significant atmospheric emission reductions and improved resource utilization through enhanced combustion efficiency. Most of the less expensive measures were primarily focused on water conservation.

The generation of chloroform at Simpson Tacoma has been significantly reduced with operation of the new bleach plant and elimination of the use of sodium hypochlorite as a bleaching agent. The results demonstrate that formation of chloroform can nearly be eliminated if elemental chlorine is replaced with chlorine dioxide for pulp bleaching in the first bleaching stage. (A short technical description of the Simpson Tacoma mill's chlorine dioxide substitution results is an appendix to the EPA published document referred to at the end of this section.)

Current operating practice at Simpson Tacoma is to operate at an average 85% chlorine dioxide substitution rate for most grades and at 100% substitution for selected products. Simpson Tacoma's P2 effort reduced dioxin to non-detect levels and AOX and chloroform by 80% and 90% respectively.

In many cases, Simpson Tacoma has also realized cost savings from the pollution prevention efforts. For example, water consumption savings of 2.9 mgd from reuse of evaporator condensates result in an annual savings of about $300,000. The investment cost for that measure was only $100,000.

Simpson Tacoma's pollution prevention accomplishments to date reflect what can be achieved at basic industries involved in processing large amounts of raw materials. The major P2 benefits will accrue as production processes and utility operations are modernized and upgraded. While such projects involve investment of many millions of dollars, they can result in order-of-magnitude reductions in emissions, discharges, and generation of wastes.

Besides the several P2 measures already so successfully implemented, Simpson Tacoma will be implementing additional measures over the coming years. One of the most significant long-term recommendations, expansion of mill capacity with addition of recycle fiber, is presently under construction. This $59 million project will result in the production of 400 tons per day of recycle fiber and supplant a comparable quantity of chemically produced pulp. Through implementation of this recommendation, significant multi-media P2 benefits will be realized. It is clear that Simpson Tacoma's P2 efforts will continue to be an ongoing program.

Simpson Tacoma's P2 implementation plan, containing a commitment to make both near-term and long-term process modifications, will be used by Simpson Tacoma and the Washington State Department of Ecology as a partial fulfillment of the State's requirement for a pollution prevention plan under the State's hazardous waste law. U.S. EPA will use the plan as an example of a successful P2 plan for the pulp and paper industry.

This "Simpson Tacoma Assessment and Implementation Plan" aspect of this IP3 demonstration project is documented in the EPA publication:

Pollution Prevention Opportunity Assessment and Implementation Plan: For Simpson Tacoma Kraft Company (EPA 910/9-92-027 August 1992).

Model P2 Plan

The project also developed, for use at other mills, a model P2 plan for pulp and paper mills:

> Model Pollution Prevention Plan for the Kraft Segment of the Pulp and Paper Industry (EPA 910/9-92-030 September 1992).

The model P2 plan provides a generic process-by-process assessment of pollution prevention opportunities for the kraft segment of the pulp and paper industry. The process areas covered are:

- woodyard operations
- pulping and chemical recovery
- pulp bleaching
- pulp drying and papermaking
- wastewater treatment

For each specific P2 option within each process area, the model P2 plan provides a:

- description
- cost estimate
- discussion of applicability
- estimate of environmental benefits
- list of references

This model P2 plan also presents an organizational and management framework for establishing a P2 program at a mill, describing the importance of:

- management commitment
- the establishment of a P2 team
- tracking the performance of P2 measures after implementation.

Results

The primary reason for developing the model P2 plan was so that it could be used by other pulp and paper mills. The model P2 plan has been made widely available, especially in the Pacific Northwest, and has indeed been used by other pulp and paper mills.

Another reason for developing the model P2 plan was so that the model P2 plan could be used, not only by other pulp and paper mills, but also by permit writers and by those involved in the settlement of enforcement cases. The model P2 plan does contain much useful information for permit writers and enforcement personnel, and numerous copies were distributed, especially in the Pacific Northwest. Permit writers and those involved in enforcement settlements have indeed used it, and it has proved to be very useful.

Bibliography

This IP3 demonstration project also produced an extensive, annotated bibliography on pollution prevention for the kraft pulp and paper industry:

> Pollution Prevention for the Kraft Pulp and Paper Industry: Bibliography
> (EPA 910/9-92-031 September 1992)

It is organized by process area, as follows:

- Chip Preparation
- Chemical Pulping
- Pulp Washing
- Bleaching
- Chemical Recovery
- Recausticizing
- Power Generation
- Wastewater Treatment
- Papermaking
- General Plant

The document contains 269 citations. Each citation contains: title, author, reference, and a brief synopsis.

EPILOGUE

As a result of participation in the IP3, Simpson Tacoma received very favorable local and national recognition. This recognition resulted in benefits not originally expected by the company.

First, the company gained a fresh perspective on U.S. EPA and now sees the agency as more than just a regulator. Simpson Tacoma now has increased confidence in dealing with the agency on technical or process related issues. Simpson Tacoma also believes that its experience through the IP3 demonstration project has shown to other companies that EPA will work with companies in a cooperative manner.

Second, the recognition has brought other state and federal voluntary programs to Simpson Tacoma that have maintained the momentum of the original IP3 effort. Subsequent to the IP3 demonstration at Simpson Tacoma and the company's implementation of the project's P2 recommendations, a State of Washington project on measuring pollution prevention has been conducted at the facility. In addition, Simpson Tacoma submitted an application to U.S. EPA's Environmental Leadership Program and was one of only 10 private companies selected nationwide!

In light of the IP3's objective to spread the P2 ethic, it is perhaps not without significance that, under the Environmental Leadership Program, one of Simpson Tacoma's projects will be to conduct a supplier mentoring program whereby Simpson Tacoma will now work to help enhance the environmental performance of its suppliers.

Table 1

SIMPSON TACOMA KRAFT COMPANY
ADDITIONAL POLLUTION PREVENTION RECOMMENDATIONS

	Project		Benefits	Estimated Cost	Proposed Priority
WOODYARD - CHIP HANDLING					
1	Fugitive dust control	M	Minimize dust emissions to St. Paul waterway and Inner Commencement Bay	Minor/Low $100,000 - 1,000,000	1
2	Stormwater control near chip unloading station	L	Minimize chip spillage to St. Paul waterway and Inner Commencement Bay	Minor < $100,000	2
3	Chip thickness screens	L	More uniform pulp quality; less bleach plant chemical consumption	Medium/High $4 - 6,000,000	3
PULPING AND CHEMICAL RECOVERY					
4	Expansion of NCG system	M	Incremental TRS reductions from smelt tanks, liquor storage tanks and filters	Medium > $1,000,000	1
5	Replace No. 2 and 3 brownstock washers	M	TRS and VOC reductions; water conservation	High $20,000,000	2
6	Black liquor spill prevention and recovery	H	TRS and VOC reductions; BOD_5 reductions; WWTP efficiency improvements; cost savings	Medium > $1,000,000	1
7	Steam stripping foul condensates or incinerating emissions in the power boiler	H	TRS and VOC reductions; water conservation	Medium/High $4 - 8,000,000	1
8	Expand mill capacity with addition of secondary fiber	H	Utilize waste material	High > $5,000,000	1
9	Replace existing batch digester kraft capacity with secondary fiber	H	Utilize waste material; replace poorly controlled kraft processes with low pollutant generating process	High $10 - 12,000,000	2
10	Exhaust smelt tank vents to No. 7 power boiler	M	Reduce TRS emissions; reduce particulate emissions	Medium > $1,000,000	2
11	Upgrade or replace No. 3 recovery boiler	H	Improve chemical recovery and mill efficiency; reduce TRS and particulate emissions	High $35 - 100,000,000	2
12	New MCC digester for bleached stock	M	More uniform pulp quality; less bleach plant chemical consumption; lower formation of chlorinated compounds	High $50,000,000	2
13	Use indirect heaters on batch digesters	M	Condensate savings and water conservation; lower hydraulic load on evaporators	Low < $1,000,000	3
14	Utilization of boiler ashes (grate ash, air heater/multiclone ash, fly ash)	H	Utilization of waste materials; reduction in landfill use; more effective use of hogged fuel; cost savings	Low < $1,000,000	1
BLEACHING					
15	Use of oxygen delignification or addition of bleaching or extraction stage	H	Reduce bleach plant chemical consumption; reduce formation of chlorinated compounds	High $15 - 20,000,000	2
16	Operate bleach plant at 100 % chlorine dioxide substitution (would require additional ClO_2 generator capacity)	M	Reduced chloroform and chloro-phenols generation; produce chlorine-free pulp; better process control; eliminate chlorine handling	High; Increase in operating costs $10,000,000	2
PULP DRYERS AND PAPER MACHINES					
17	Save-alls on pulp dryers	L	Fiber recovery; water conservation	Medium > $1,000,000	3

Table 1 (continued)

SIMPSON TACOMA KRAFT COMPANY
ADDITIONAL POLLUTION PREVENTION RECOMMENDATIONS

	Project		Benefits	Estimated Cost	Proposed Priority
18	Improve steam condensate recovery	L	Condensate savings; energy savings; reduce hot water to sewer; minimize boiler feedwater treatment	Low < $1,000,000	2
19	Improve water conservation and reuse	L	Water conservation; reduce hydraulic and waste loading to WWTP	Low < $1,000,000	1
WASTEWATER TREATMENT					
20	Control ammonia addition to minimize effluent residual	M	Reduced effluent discharges of ammonia to Inner Commencement Bay; cost savings	Minor < $100,000	2
GENERAL MILL OPERATIONS					
21	Replace PCB transformers (ongoing)	M	Risk avoidance	Medium > $1,000,000	3
22	Asbestos removal/renovation (ongoing)	M	Risk avoidance; reduction in liability	Medium - High > $1,000,000	3
23	Increase bulk/semi-bulk purchases; eliminate drums (ongoing)	L	Risk avoidance; cost savings	Minor < $100,000	1
24	Increase steam condensate recovery	L	Condensate savings; energy savings; reduce hot water to sewer; minimize boiler feedwater treatment	Low < $1,000,000	2
25	Improve water conservation and reuse	L	Water conservation; reduce hydraulic and waste loading to WWTP	Medium > $1,000,000	1
26	Minimize miscellaneous hazardous waste	M	Risk avoidance	Minor	1