



# Project Summary

## Diaper Industry Workshop Report

Clyde Dial and George Wahl

**This report is the product of a 1-day workshop on the diaper industry that was sponsored by the U.S. Environmental Protection Agency (EPA). Four topics were covered during the workshop: public health and safety, recycling, composting, and product life cycle analysis. The primary objective of the workshop was to identify areas within the diaper industry that need further research that will lead to minimizing the negative effect that diapers have on the environment. This report can be used by both the private and the public sector to pursue such research.**

***This Project Summary was developed by EPA's Risk Reduction Engineering Laboratory, Cincinnati, OH, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).***

### Introduction

In response to the recent heightened concern about the effect that diapers have on the environment, and as part of EPA's continuing effort to transfer technical information to the public, EPA held a 1-day workshop on the diaper industry. More than 30 representatives from industry, government, consulting firms, and waste handling companies came together to discuss issues relating to diapers and to identify areas needing further research. The workshop was not a forum for debating whether disposable or reusable diapers were the more environmentally sound choice. The topics discussed during the workshop were

public health and safety, recycling, composting, and product life cycle analysis.

The research needs defined during the course of the workshop are detailed in the report summarized here. Both the private and the public sector can use the full report to select research projects that will lead to improving diapers and lessening their negative effect on the environment.

### Procedure

The focus topics for the workshop were selected for their relevance to the diaper industry and to the research that EPA is currently pursuing. The chosen participants represented diverse knowledge and viewpoints about the current state of the diaper industry: the reusable and the disposable diaper manufacturers; waste haulers, recyclers, and composters; consulting firms that have conducted life cycle analyses of diapers; academia; and various EPA offices.

Each of the four sessions, one on each of the focus issues, began with a brief presentation on the issue, was followed by a discussion period, and concluded with a summary of the research issues that the participants had identified during the discussion period.

The overviews and research needs are summarized, by topic, below. The research needs are limited to the knowledge of the participants at the workshop and are not meant to be comprehensive. In addition, some of the issues discussed in this report may have already been researched, but the workshop participants were unaware of the research.

## Public Health and Safety

### Overview

To open this session, Wayne Turnberg of the Washington State Department of Ecology gave a presentation on the Washington State Infectious Waste Project. This study, which assessed the risk of human infectious disease acquired during the course of disposal, concluded that human pathogens are routinely introduced into the solid waste stream from residential sources including disposable diapers and from medical waste stream sources. Once in a properly operated landfill, pathogens are not likely to migrate and may become inactive. No evidence of human infectious disease from infectious agents present in municipal solid waste landfills or the waste stream was identified based on the literature search conducted for the report.

### Research Needs

Human exposure considerations as they relate to the diaper industry must be further examined for a better understanding of the human exposure aspects of handling and processing soiled diapers to provide ways to control such exposure. Below are examples of creditable information that should be obtained and distributed.

- A study is needed of the occupational infection risk to waste workers and the source of that risk. Serologic markers for hepatitis B and other appropriate pathogens should be employed. This study should identify risks associated with collection, handling, and processing of these waste materials.
- A study is needed of the captured aerosols found in the void spaces of closed receptacles (i.e., plastic trash bags) containing soiled diapers and the effect of these aerosols on humans during handling and collection of these containers by reusable diaper services. Human exposure to these aerosols during the laundering of reusable diapers should be evaluated. Exposure assessments during collection of disposable diapers and their handling during recycling or composting are needed.
- An epidemiological study is needed to determine any health risk associated with recycling or with composting practices of this solid waste.

Additional public health and safety research not related directly to human exposure should:

- examine the survivability of pathogens in the reusable diaper wash process;
- evaluate different biocides used for sanitizing reusable diapers;
- define, quantitatively, the sources of microorganisms that enter the waste stream, including human and animal wastes;
- determine the need for biological testing of landfills to monitor human pathogens; and
- study the macro effects of combining sewage sludge with the municipal solid wastestream.

## Recycling

### Overview

The first presentation, given by Nancy Eddy of Procter and Gamble, focused on the Seattle Diaper Reclamation Project. This is a cooperative effort among Procter and Gamble (manufacturer of disposable diapers), the Seattle Solid Waste Utility, a local diaper service, and Rabanco (a solid waste recycling firm). The goal is to determine the technical and economic feasibility of recycling disposable diapers.

During the course of the project, the potential market for reclaimed pulp, plastic, and absorbent gel materials will be determined, and the Seattle Solid Waste Utility will complete an economic evaluation, which will be verified by an independent consulting firm. If recycling is deemed economically feasible, the project will be turned over to Rabanco for continuous processing of disposable diapers. This project began in June 1990.

The second presentation, given by Gerry Sheehan of Weyerhaeuser, focused on Weyerhaeuser's San Diego Recycling Project. The goal of the project was to design a recycling process that was economically feasible, was insensitive to market fluctuations, required minimal capital, and required no major changes in current consumer habits. The drawbacks revealed by the project included contamination of the recovered pulp with absorbent gel material, high water usage, and costly delivery and pickup of diapers. Future research efforts include proving that the reclaimed pulp's purity is not impaired because of gel contamination, testing the pulp for composting, exploring low-cost methods for extracting gel, and investigating ways to include disposable diapers from the retail trade in the collection program.

### Research Needs

Research related to improving the quality of recycled diaper material should:

- determine the impact of contamination by gelling material on pulp quality;
- explore low-cost methods for extracting gelling material;
- find methods to efficiently separate different types of plastics;
- develop catalysts that enhance the properties of co-mingled plastics;
- study the feasibility of reducing the diversity of plastic for diaper liners, bags, adhesive strips, and elastics;
- evaluate the effect of different collection and separation methods on the cost of recycling and consumer acceptance;
- conduct material balances to determine how much reclaimed pulp and paper are actually returned to the market and not discarded as process waste;
- determine the energy requirement for reclamation; and
- include collaborative efforts among the EPA, the Department of Commerce, the Food and Drug Administration, and the General Services Administration to examine which government actions can selectively "promote" use of reclaimed materials.

## Composting

### Overview

The first presentation, given by Nancy Healy of Recomp, focused on the St. Cloud, Minnesota, Diaper Compost Project. The goal of this project was to demonstrate the viability of composting disposable diapers. For this project, the percentage of diapers entering St. Cloud's aerobic composting process was increased from approximately 2% to 7.6% of the municipal solid waste feed to magnify the effects of disposable diapers on the composting process. Preliminary results indicate that the compost produced in this study did not differ from the normal compost produced at the St. Cloud facility. The plastic backsheets from the diapers are not compostable and were removed during the composting process by screens that eliminate materials over 1.5 in. in diameter.

For the second presentation, Steven Howard of Amerecycle provided an overview of the Sumpter County, Florida, Compost Facility. Before being composted, the

municipal solid waste goes through several processes at this facility including segregation of household hazardous waste, shredding, magnetic separation, metal detection, hand-sorting, and moisture addition. The waste is then placed in open-air windrows. Aeration and inoculation with microorganisms are used to promote composting. This facility has not conducted any specific studies on composting diapers but has had no problems from the diapers that are processed at the facility.

### **Research Needs**

Further research in composting should:

- conduct a systems study comparing composting with landfilling,
- compare sewage sludge composting with municipal solid waste composting,
- perform pilot studies on the separation of diaper materials,
- examine how trace impurities (like gel material) affect the quality of compost material, and
- determine the economic viability of composting.

Other research not directly related to composting should:

- compare aerobic and anaerobic degradation in a controlled landfill with an outlet provided to collect methane, and
- conduct feasibility studies on the development and use of a flushable diaper.

## **Product Life Cycle Analysis**

### **Overview**

Jere Sellers of Franklin Associates provided an overview of product life cycle analysis (PLA). PLAs must examine multimedia factors including energy use, natu-

ral resource use, the quality of air, water, and land when determining the environmental impacts of a product. Comparison of products within a PLA must be fair and unbiased. Franklin Associates is currently doing a life cycle analysis on various diaper products for the American Paper Institute.

Anthony Montrone of Arthur D. Little gave a presentation on his firm's PLA of diapers. The study examined the health, environmental, and economic effects of both reusable and disposable diapers. The study showed that both types of diapers negatively affect the environment. Disposable diaper manufacture and use generate more municipal solid waste than do reusable diapers. Reusable diapers use more energy and water and result in higher levels of total air and water pollution.

### **Research Needs**

Research needs related to life cycle analysis centered on the need to provide guidance on approaches to conducting these analyses and their use. Further life cycle studies should:

- identify the variables that significantly affect the final results for all diaper-related life cycle analyses,
- determine where diaper-related life cycle analysis should begin and end, and
- use life cycle analysis to find target areas that should be changed to reduce the environmental effects of both single-use and reusable diapers.

### **Summary Statement**

The diaper industry workshop focused on four important issues: public health and safety, recycling, composting, and product life cycle analysis techniques. A majority of participants believed that the health and safety issues related to diapers currently receive more public scrutiny than is warranted. They concluded that there is

probably no significant public health and safety problems related specifically to diaper handling, recycling, or disposal in properly operated and constructed landfills. Because diaper disposal is a highly visible public issue, however, more definitive health and safety studies should be conducted on the handling and processing of diapers. This would clearly enable public health officials to define any health and safety issues related to diaper handling and to dispel unwarranted fears about health problems associated with diapers.

The issues related to recycling and composting of diaper materials focused on how to make these technologies economically viable. The consensus of the participants was that the major issues related to recycling, beyond making it economically feasible, were the quality of the product and the acceptance of recycled materials in the marketplace.

The conclusion from the PLA discussion was that these techniques are an excellent way to identify aspects of a product's life cycle that can be targeted for further study. Such studies would focus on ways to increase the length of product life, the reuse of product materials, or ways of producing the product that result in less waste.

Many research needs were identified during the course of this workshop. Further investigation into these research issues by both the private sector and the public sector will lead to opportunities to lessen the adverse environmental impacts of diapers and to improve the health and safety of those who come into contact with diapers. Initiation of research projects in this area by EPA is contingent on the Agency's priorities.

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**Mary Ann Curan** is the EPA Project Officer (see below).

*The complete report, entitled "Diaper Industry Workshop Report," (Order No.  
PB91-191 262/AS; Cost: \$15.00, subject to change) will be available only from:*

*National Technical Information Service*

*5285 Port Royal Road*

*Springfield, VA 22161*

*Telephone: 703-487-4650*

*The EPA Project Officer can be contacted at:*

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