

February 3, 2004



Kelly Wolf
County Recycling Coordinator
Dauphin County
Second and Market Streets
Harrisburg, PA 17108

Subject: Analysis of the Materials Recovery Facility Design and Specifications

Dear Ms. Wolf:

This final report summarizes R. W. Beck's peer review and analysis of Navarro & Wright Consulting Engineers' November 7, 2003 draft design of the Dauphin County (County) materials recovery facility (MRF) and corresponding general construction project manual (specifications) dated December 15, 2003. R. W. Beck's review was completed in December of 2003 and a draft letter report was submitted to the County on January 2, 2004.

Based on our initial report, Navarro & Wright has responded by providing the County with suggested changes to the design and specifications, or explanations stating why changes would not be made. These comments are summarized in bullet form at the end of each category in this report. Full details can be found in the attached January 29, 2004 letter to R. W. Beck from the County, included as Attachment 1.

The MRF plans were evaluated on the basis of the size of the tip floor and storage area, the layout of the equipment, the flow of materials through the facility, the technical contract provisions considered for inclusion in the procurement documents, and other recommendations to assist the County in the design, contracting, and construction of the proposed facility.

In the preparation of this review and the opinions that follow, R. W. Beck has made certain assumptions with respect to current and future conditions. In addition, we have used and relied upon certain information and assumptions provided to us by County staff and Navarro & Wright staff. We believe the use of such information and assumptions is reasonable for the purposes of this review. However, some assumptions will invariably not materialize as stated herein or may vary significantly due to unanticipated events and circumstances. R. W. Beck's assumptions include:

- The MRF will be owned by the County, but the operation of the facility will be contracted to a private company.
- The County received a grant for approximately 1.5 million dollars for the design and construction of the MRF. The facility was designed within the budget limitations.
- The MRF is designed to process recyclable materials collected in two streams: fiber and containers. The County may have a need or desire to accept single stream materials in the future. This report includes a discussion of the feasibility of retrofitting the facility to accommodate recyclable materials collected in one stream.

Overview

The MRF is designed to process fifty tons per day of recyclable material, plus a limited quantity of old corrugated cardboard (OCC). The fifty tons per day estimate was based on the quantity of residential recyclables currently collected from curbside programs within the County. The County will work with municipalities within the County to direct their recyclables to the County's MRF via collection contracts between the municipalities and their haulers when those contracts are re-bid or renewed.

The County also anticipates the MRF will be used by private haulers who collect OCC from commercial businesses in the Harrisburg area. These haulers would have a financial incentive to use the MRF because they could avoid transportation costs of transporting the OCC (and other recyclables) to York, where the nearest MRF is located, approximately 26 miles away. The County should encourage haulers to bring commercial OCC to its MRF because OCC is a recyclable commodity that may historically generate a large percentage of a MRF's revenue and usually requires limited sorting and handling. Depending on the quantities of OCC delivered by the various haulers, the County may consider revenue sharing with the private haulers as an incentive to acquire their OCC. If feasible, R. W. Beck recommends the County consider expanding the facility to the south to accommodate larger volumes of commercial OCC. If this is not feasible, additional labor requirements may be necessary to accommodate any increase in volume of recyclable materials.

Tipping Floor

According to industry standards, the size of a MRF tipping floor should be large enough to accommodate at least three days' worth of materials. Navarro & Wright assumed the tipping floor could hold nearly one days' receipts of fiber and ½ days' receipts of containers. R. W. Beck believes this amount of space is inadequate. If any of the mechanical equipment within the MRF malfunctions or breaks down, the County may need to store loose recyclable materials for several days. The County should have a contingency plan in place for times when recyclable materials cannot be processed immediately (i.e., have storage options available, or have agreements with other facilities to allow materials to be directed to other MRFs in the interim).

Navarro & Wright did suggest to the County that the tipping floor be expanded to the west to provide a larger receiving area, and informed R. W. Beck that there is approximately twenty feet of space available on the west side of the building. However, it was also mentioned that this extra twenty feet could be used to retrofit the building for single stream processing in which case the extra space would be used to accommodate paper separating equipment such as star screens or disk screens.

The County and Navarro & Wright offered the following feedback to address our suggestions:

- *In order to accommodate the need for storage of recyclable materials, two (2) 40 cubic yard roll-off containers will be incorporated as a contingency in the event that the recyclable materials cannot be processed immediately. One roll-off will be used for commingled*

containers and the other for fiber. Additional roll-offs could be provided for an extended “down time.”

Fiber Line

The fiber line is designed for commingled mixed paper, OCC, and old newspaper (ONP) to be sorted into separate streams. The ONP will be negatively sorted meaning the OCC, mixed paper, and any contaminants will be hand picked off the sort line and the ONP will be conveyed to the baler. The OCC and mixed fiber will each have a designated chute from the elevated sort line to a bunker located underneath the sort line. It is not clear based on the facility drawings where the garbage or contaminants will be sent. A garbage chute should lead from the sort line to a dumpster located underneath the sort line. When full, the dumpster could then be wheeled or picked up with a forklift and brought to the garbage compactor located on the north side of the building. Navarro & Wright pointed out to R. W. Beck that a redirection chute will be located at the end of the processing line to allow ONP to be discharged back to the tipping floor if there is not an adequate quantity of ONP to make a full bale. This chute should be clearly labeled on the final drawings.

The County and Navarro & Wright offered the following feedback to address our suggestions:

- *An “L” shaped conveyor has been added to transport garbage from the fiber line to a roll-off located outside the building.*
- *Additionally a redirect chute for the ONP on the process line has been added to the plans, and described in the technical specifications, to redirect ONP back to the tipping floor in the event of baler feed conveyor and/or baler maintenance.*

Container Line

The MRF is designed for commingled glass, plastics, and cans to be sorted into separate streams. It is R. W. Beck’s understanding that sorters will be stationed at the top of the incline conveyor to pick off any trash that may be in the container stream. Navarro & Wright stated that trash would be deposited into a chute leading to a trash transfer conveyor that will go through the push wall and then into the compactor on the north side of the building. This trash transfer conveyor is not shown on the facility drawings. A cross belt magnet will remove ferrous cans and the cans will be directed into a large self-dumping bin. The remaining containers will move onto a glass breaking screen that is designed to break approximately 95% of the glass bottles to a 1.5” minus size, per Navarro & Wright, although the drawing is labeled 2” minus. The glass is then discharged into a 6-yard hopper for further processing. The glass is not separated by color. The remaining containers (aluminum cans and plastic) pass over a sizing screen which discharges the single serve plastic containers plus any un-crushed glass onto an Eddy Current separator which picks off the aluminum and deposits it into a self-dumping hopper. The remaining materials, primarily large plastic bottles, are discharged onto a conveyor where any remaining trash and aluminum cans are hand picked and directed to those streams respectively.

The remaining plastics move onto an elevated conveyor leading to a perforator. The perforator reduces the bulk of the plastic bottles by tearing or twisting the plastic to reduce the likelihood of the bottles springing back to their original shape. The perforated plastic is then deposited into a self-dumping hopper.

The County and Navarro & Wright offered the following feedback to address our suggestions:

- *The trash conveyor has been added to the facility drawings.*
- *The facility drawing has been revised so that the glass breaking screen reads 1.5" minus.*

Plastics

The County currently ships its plastics mixed, i.e., there is no separation of Polyethylene Terephthalate (PET) and High Density Polyethylene (HDPE). The County states that the plastic is separated at the end user and reports recent pricing for plastics as:

PET	\$0.11 per pound
HDPE Natural	\$0.13 per pound
HDPE Colored	\$0.11 per pound

It is unusual for end markets to pay prices this high for plastics that are not separated by resin type. Recent pricing for mixed plastics is approximately \$0.06 to \$0.08 per pound. The November 28, 2003 pricing for baled plastics, as reported by Waste News, for the New York region is as follows:

PET	\$0.15 per pound
HDPE Natural	\$0.21 per pound
HDPE Colored	\$0.17 per pound

Using the County's November quantities of plastic of 8,480 pounds, and applying a typical breakdown by resin type of 50% PET, 25% Natural HDPE, and 25% Colored HDPE, we calculate that the County would have received \$1,441.60 for the month had the materials been sorted and baled by plastic type, compared to an estimated \$975.20 that the County would have received with the percentages listed above at the prices the County is reportedly receiving. The difference is \$466.40 per month or approximately \$5,597 per year. The County may want to consider separating the plastics by resin type and instead of having one large self-dumping bin for all plastics, divide the space into three sections and have one self-dumping hopper each for PET, natural HDPE, and colored HDPE. Further analysis of the labor requirements for separating plastics is recommended.

The County and Navarro & Wright offered the following feedback to address our suggestions:

- *In order to accommodate the suggested separation of plastics by resin type, it would be necessary to expand the building footprint. Based on the budget constraints of the project, this was not deemed cost effective.*

Glass

Because of limited glass container processing plants in the United States, it is not always feasible to recycle glass back into container glass in certain parts of the country. When it is feasible, the glass must be separated by color (clear, brown, and green). From discussions with County staff, it does not appear the County has an end market at this time for the mixed color crushed glass that will be produced at the MRF. County staff did mention the possibility of working with the Pennsylvania Department of Transportation (PennDOT) to find an end use. From PennDOT's website, glass cullet has been used in the following applications (some on an experimental basis only):

- Nonstructural fill;
- Drainage pipe backfill;
- Coarse aggregate in grout;
- Coarse aggregate in asphalt concrete base course; and
- Fine aggregate in asphalt concrete wearing course.

R. W. Beck recommends the County find an end market for the glass before the construction of the MRF begins and before it invests in glass crushing equipment. If the glass is used in aggregate mix for roadbed construction, pre-crushing may not be necessary. Some contractors will accept whole bottles and crush them in the same manner they crush the aggregate.

Obviously, crushing the glass at the MRF would reduce the amount of storage space required to stockpile the material, but the amount of crushing needed for different applications will vary and a 3/8" minus may not be required. Examples of other applications for crushed glass, besides aggregate, include the use as sandblasting media, water filtration media, and as landfill cover. Each end user has size specifications for their particular application of crushed glass. In addition, the County should keep in mind transportation costs for glass tend to be high because the weight of the glass prohibits trucks to carry full loads in order to comply with weight restrictions on local roads.

The County and Navarro & Wright offered the following feedback to address our suggestions:

- *The target market for the crushed glass is local excavating contractors. Uses may include roadway backfill, trench backfill (specifically around water and sewer pipes), landscaping, fish tanks, beach sand, infiltration areas, sandblast sand, landfill daily cover, sidewalks, gravel parking lots, flowable fill, etc. We feel that this material can be sold to excavation contractors for the above mentioned uses and others under consideration such as on-lot septic. The material will be made available for pickup from the facility at a nominal fee. Local authorities should be encouraged to use this material and incorporate it into construction specifications for roadway and pipeline projects.*

- *It should be noted that the Pennsylvania Department of Transportation specifications (Publication 408) disallow the use of glass in aggregate. It may be used as fill material.*

Storage Area

From the documents provided by Navarro & Wright, it is not clear where the baled materials will be stored until they are ready to be shipped to market. Perhaps dedicated trailers will be staged at the loading docks for the storage of baled materials. If dedicated trailers are not used, adequate space must be provided for the bales and if the bales are stored outside, it is recommended they be stored under a roof for protection from the elements, to ensure the highest quality of materials for market.

The County and Navarro & Wright offered the following feedback to address our suggestions:

- *Bale storage has been added. The area can accommodate 128 bales which equates to 1.6 days of storage for all materials to be processed.*

Building Construction

On the west side of the MRF, two 16' x 22' garage doors provide access to the tipping floor. On the south side of the building, one 12' x 20' garage door provides access for dedicated loads of OCC. R. W. Beck recommends increasing the height of all three of these garage doors to at least 24 feet. The height of recycling collection vehicles varies by manufacturer, but the table below provides an example of the sizes of recycling trucks manufactured by Heil.

Heil Recycling Vehicles				
Model	Description	Approx. Chassis Height	Height Above Chassis	Overall Height (chassis plus body)
Recycle 2000	Side load, split body, two-stream, semi-automated	42"	Body Down 104" Body Raised 220" Bin Raised 151"	Body Down 146" or 12' 2" Body Raised 262" or 21' 10" Bin Raised 193" or 16'1"
Formula 4060	Rear load, split body	42"	Body Down 98" Tailgate Raised 155"	Body Down 140" or 11'8" Tailgate Raised 197" or 16'5"
Formula 7000 Split Body	Side load, fully automated co-collection (used with split carts)	42"	Body Down 108" Body Raised 240"	Body Down 150" or 12'6" Body Raised 282" or 23'6"

The MRF is designed with an elevated ramp and a garage door on the south side of the building for vehicles to deliver dedicated loads of OCC. Depending on the number of haulers that choose to use the MRF, this area could become congested with OCC. If the amount of OCC is so great that it overflows out of the building, the County should ensure that debris fences are installed along the property lines to catch any OCC or other recyclable materials that may blow away during windy conditions.

The County and Navarro & Wright offered the following feedback to address our suggestions:

- *The door heights have been increased to 24 feet to accommodate the largest vehicles made today as per the table provided by R. W. Beck. Sheet 10 of 21 shows the revised door openings.*
- *Additionally, sheet 3 of 21 shows the 6-foot fence around the perimeter of the facility.*

Single Stream

For the County to accept recyclable materials entirely commingled as in a single stream program, mechanical separating equipment would need to be installed in front of the two sort lines. In single stream MRFs, inclined disc screens, called “star screens” are typically used to separate the fiber materials from the containers. The extra twenty feet of space available to the west of the current tipping floor would not provide adequate space for a star screen.

Another concern with processing single stream recyclable materials, is the quality of the baled material. The major concern is that the inclusion of glass may reduce the quality of the other recyclable materials, especially paper. Some municipalities do not collect glass in their single stream programs (Glendale, AZ), while others collect glass in a separate container (Seattle, WA and Cedar Rapids, IA). Most single stream programs operated by Waste Management, Inc. accept glass with the other recyclable materials. R. W. Beck recommends the County discuss single stream recycling issues, including glass, with the paper mills that are currently accepting the County’s fiber prior to accepting single stream materials.

In single stream collection programs, contamination tends to be higher because the automation of emptying residential carts into a collection vehicle does not lend itself to monitoring the materials being set out by residents. In addition, the residue from the processing of single stream recyclables tends to be higher than residue from source separated or two-stream programs. The combination of possible increased contamination and residuals from single stream programs may result in more garbage being handled at the MRF and additional disposal expenses.

The County and Navarro & Wright offered the following feedback to address our suggestions:

- *Equipment suppliers of disk screens have indicated that the 20 feet allotted for installation of a disk screen is sufficient. If necessary, the area could be expanded to 25 feet without impacting traffic flow. Conversion to a single stream will require extensive analysis including capital requirements, marketing analysis, and operational costs. It would be undertaken only if economically justifiable.*

- *It should be noted that the County is contemplating a long term operations agreement with a revenue sharing format. The respective operator would make decisions concerning end markets.*

Procurement Documents

Several sections of the Project Manual were not completed at the time of this review. Some specific sections that should be reviewed by the County include Division 8, Doors and Windows. This section should include details of the type of garage doors the County is requiring. It was not clear to R. W. Beck if the garage doors are coiling overhead doors or track overhead doors.

The equipment section (Division 11), should have generic descriptions of the type of equipment the County is requiring and a list of acceptable equipment manufacturers. We recommend the County remove the reference to Bruce Mooney Associates from this section. It is our understanding that the procurement of the equipment will be the responsibility of the construction contractor and Bruce Mooney Associates is just one of the possible equipment vendors.

The County and Navarro & Wright offered the following feedback to address our suggestions:

- *The procurement documents have been revised removing the reference to Bruce Mooney Associates. A copy of the revised specifications and drawings will be provided by Navarro & Wright under separate cover.*

Conclusion and Recommendations

It is R. W. Beck's opinion that the overall layout of the MRF and the equipment configuration is adequate. The areas of main concern are the size of the tipping floor and the feasibility of converting to a single stream system in the future. Further research is needed to confirm the types and quantities of recyclable materials that could be directed to the MRF.

The recommendations made in this report are summarized below.

- Encourage haulers to bring commercial OCC to the MRF and consider sharing a portion of the revenue from the sale of recyclable materials with the haulers as an incentive to bring in more commercially-generated material.
- Expand the facility to the south to accommodate larger volumes of commercial OCC. If this is not feasible, additional labor requirements may be necessary to accommodate any increase in volume of recyclable materials.
- Expand the size of the tipping floor to accommodate three days' worth of recyclable materials.
- Develop a contingency plan in the event the processing equipment is inoperable for several days.

- Ensure that the facility drawings include waste handling equipment such as trash chutes from the fiber and container sort lines, and a trash transfer conveyor leading to the compactor.
- Ensure that the “redirection chute” on the fiber sort line is included in the final facility drawings.
- Verify the size of the material to be discharged from the glass breaking screen (i.e., 1.5” or 2” minus).
- Consider separating plastics by resin type to potentially receive higher prices from the end user(s). Further analysis of the labor requirements for separating plastics by resin type is recommended.
- Find an end market for the glass before the construction of the MRF begins and before glass crushing equipment is purchased.
- Ensure adequate storage space is available for baled materials.
- Increase the height of all three garage doors to at least 24 feet.
- Ensure that debris fences are installed along the property lines to catch any recyclable materials that may blow away during windy conditions.
- Conduct further analysis on the feasibility of accepting recyclable materials commingled from single stream collection programs.
- Remove the reference to Bruce Mooney Associates from the Equipment section of the specifications.

Subsequent to our submittal of these recommendations, the County and Navarro & Wright made appropriate changes or provided clarifications where possible, or identified appropriate contingency plans. The full list of improvements and clarifications that were made as a result of R. W. Beck’s review are included in Attachment 1 to this letter. We believe that these changes and clarifications will make the MRF more successful and capable of handling recyclables for the Dauphin County market.

Kelly Wolf
February 3, 2004
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Thank you for the opportunity to review the County's MRF design and specifications. Please contact me at (651) 994-8415 if you have any questions.

Sincerely,

R. W. BECK, INC.

Mary Chamberlain
Environmental Analyst

c: Carl Hursh, DEP
Brent Dieleman, SWANA

ATTACHMENT 1

DAUPHIN COUNTY

DEPARTMENT OF SOLID WASTE MANAGEMENT & RECYCLING

DAUPHIN COUNTY ADMINISTRATION BUILDING
2 SOUTH SECOND STREET
HARRISBURG, PA. 17101
(717) 780-6351
(717) 780-6494 FAX

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January 29, 2004

Ms. Mary Chamberlain
R. W. Beck, Inc.
1380 Corporate Center Curve, Suite 305
St. Paul, MN 55121

RE: Dauphin County Material Recovery Facility
Dauphin County, Pennsylvania

Dear Ms. Chamberlain:

This letter addresses the Navarro & Wright Consulting Engineers, Inc. (Navarro & Wright) responses to your comments from a letter dated January 2, 2004 for the above referenced project. The responses are separated into the same categories as your comments for easy reference.

Tipping Floor

In order to accommodate the need for storage of recyclable materials, two (2) 40 cubic yard roll-off containers will be incorporated as a contingency in the event that the recyclable materials cannot be processed immediately. One roll-off will be used for commingled containers and the other for fiber. The roll-offs will be placed in the parking lot in a position so as not to interfere with traffic flow. If the facility needs to begin storing, rather than processing recyclable materials, then the trucks carrying the recyclable materials will be emptied into front end loaders which in turn would deposit the material into the appropriate roll-off. When the processing of the materials can resume again, the roll-offs would be brought to the tipping floor with a lift truck and emptied into the appropriate hopper area for processing. Additional roll-offs could be provided for an extended "down time."

Fiber Line

An "L" shaped conveyor has been added to transport garbage from the fiber line to a roll-off located outside the building.

Additionally a redirect chute for the ONP on the process line has been added to the plans, and described in the technical specifications, to redirect ONP back to the tipping floor in the event of bailer feed conveyor and/or bailer maintenance.

Container Line

The trash conveyor has been added to the facility drawings.

The facility drawing has been revised so that the glass breaking screen reads 1.5" minus.

Plastics

In order to accommodate the suggested separation of plastics by resin type, it would be necessary to expand the building footprint. Three (3) containers of approximately 12'x12' would be necessary to store the separated plastics. This translates into an additional 432 square feet of required building space. The average cost for the building is estimated at \$70 per square foot; yielding an additional \$30,240 onto the construction cost of the building. At a revenue generation rate of \$5,597 per year yields a payback period of 5.4 years for the building alone. In addition to the costs for the increased building space are costs for self-dumping bin, conveyors, and the cost for additional labor for processing. Based on the budget constraints of the project, this was not deemed cost effective.

Glass

The target market for the crushed glass is local excavating contractors. Uses may include roadway backfill, trench backfill (specifically around water and sewer pipes), landscaping, fish tanks, beach sand, infiltration areas, sandblast sand, landfill daily cover, sidewalks, gravel parking lots, flowable fill, etc. We feel that this material can be sold to excavation contractors for the above mentioned used and others under consideration such as on-lot septic. The material will be made available for pickup from the facility at a nominal fee. Local authorities should be encouraged to use this material and incorporate it into construction specifications for roadway and pipeline projects.

It should be noted that the Pennsylvania Department of Transportation specifications (Publication 408) disallow the use of glass in aggregate. It may be used in the fill material.

Storage Area

Bale storage has been added, see revised sheet 3 of 21. The area can accommodate 128 bales which equates to 1.6 days of storage for all materials to be processed.

Building Construction

The door heights have been increased to 24 feet to accommodate the largest vehicles made today as per the table provided by R. W. Beck. Sheet 10 of 21 shows the revised door openings.

Additionally, sheet 3 of 21 shows the 6-foot fence around the perimeter of the facility.

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It should be noted that the County is contemplating a long term operations agreement with a revenue sharing format. The respective operator would make decisions concerning end markets.

Procurement Documents

The procurement documents have been revised removing the reference to Bruce Mooney Associates. A copy of the revised specifications and drawings will be provided by Navarro & Wright under separate cover.

If you have any questions or require any additional information, please do not hesitate to contact our office.

Sincerely,

Kelly Wolf

Kelly Wolf
County Recycling Coordinator

CC: Jeff Haste, Chairman
Dan Lispi, City of Harrisburg
Carl Hursh, DEP
File