

Examination of Wyoming's Landfill Problems: a White Paper

Wyoming Department of Environmental Quality
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I. Introduction

At its October 12, 2004 meeting, the Joint Minerals, Business and Industrial Development Interim Committee (the Committee) directed DEQ to prepare a paper examining the impacts of a proposed bill, the Community Landfill Remediation Act (05-LSO-0137.W3). The Committee asked DEQ to more clearly address issues such as the significance of leaking landfills, the scope of the problem and what it will cost to address, and the impacts the bill is likely to have on communities. The Committee also requested that DEQ prepare a section-by-section plain language description of the bill's provisions, and that document will be provided under separate cover. To address the Committee's requests, this paper discusses the problems which can be caused by leaking landfills; it talks about how DEQ and the Citizens' Advisory Group developed solutions to the problem; it discusses DEQ's estimate of how many landfills will need remediation; it explains how DEQ calculated remedial costs; and it ends with an economic analysis of the impact the bill would have on Wyoming communities..

II. What is the Problem?

Wyoming landfills create leachate, and leachate contaminates groundwater¹.

Throughout the 70's, 80's and 90's, landfills across the country were built with liners to protect groundwater, but we in Wyoming continued to operate unlined landfills. Why? We thought that Wyoming was too arid for its landfills to create leachate, but we were wrong.

How do we know we were wrong? Twenty-one of Wyoming's 130 municipal solid waste landfills are now known to be leaking. In 2002 and 2004, we contacted 19 lined landfills in states surrounding Wyoming, all of which are located in similar arid and semi-arid environments. We found that all but 2 of those 19 lined landfills are collecting leachate in quantities sufficient to pollute groundwater. The operator of one of those landfills reports that a thick soil layer installed over the top of the collection pipes may be impeding flow of leachate to the liner system.

Why is this a problem for us? Landfill leachate is a toxic, noxious liquid. It contains pollutants which are harmful to human health, at concentrations as much as 1,000 times the drinking water standards. For example, a typical value for benzene in landfill leachate is 0.221 mg/l, which poses a cancer risk of about 1 in 1,000 (a generally accepted cancer risk for

¹ A more complete discussion of Wyoming's landfill problems can be found in the memo: Nature and current status of landfill impact problem, Anderson, Dale; Wyoming Department of Environmental Quality, December 17, 2004.

drinking water contaminants is 1 in 1,000,000). Even after leachate leaks down through soils and is mixed with clean groundwater beneath a landfill, concentrations of landfill leachate in groundwater around some of Wyoming's leaking landfills still exceeds drinking water standards by as much as 40 times the standards.

We used to think that these landfills were in the middle of nowhere, and even if some pollution leaked out of them it wouldn't hurt anyone. While that once might have been true, our population centers have grown and people are encroaching on these landfills. All but 19 of the 130 landfills in Wyoming have at least one groundwater well within a mile; 48 of those 130 landfills have more than 11 wells within a mile; and six have more than 50 wells within a mile.

Other states closed smaller, unlined landfills and replaced them with collection services or transfer stations to haul garbage to larger, safer lined regional landfills. DEQ believes it is time to take these steps in our state as well, and the landfill bill under consideration is intended to help our local governments make those difficult decisions and provide safer landfills for our future.

III. How the problem has been addressed

Authority currently exists for DEQ to require landfills to be constructed with liners, and to compel responsible parties to remediate contamination from leaking landfills. In fact, most of the state's largest landfills (Cheyenne, Sheridan, Gillette) are already operating in lined areas. New landfills planned for Cheyenne and Casper will be constructed with liners. These larger cities also have older unlined landfills that are leaking, and the cities are performing work leading to decisions on remedial measures.

Many of Wyoming's landfills, however, are owned and operated by smaller communities who lack the financial resources to build and operate lined landfills, and to carry out expensive remediation programs. In recognition of this concern Governor Freudenthal directed DEQ to convene a Citizens' Advisory Group with broad representation to develop collaborative solutions to the problem.

The Citizens' Advisory Group met over a period of nine months, and issued its report to DEQ and Governor Freudenthal in September, 2004². The group recommended enactment of legislation to provide incentives to communities to close smaller, unlined landfills and to cooperate in developing safer and more economic lined regional landfills. The group also recommended legislation to allow the state to set recycling goals, and to help local governments plan to determine the best ways to meet those goals. The solutions advocated by the Citizens' Advisory Group are embodied in the Community Landfill Remediation Act which is being sponsored by the Joint Minerals, Business and Economic Development Interim Committee. DEQ believes the recommendations of the Citizens' Advisory Group are reasonable, and fully supports the solutions advocated by the group.

The landfill bill is intended to provide incentives to communities to close smaller unlined landfills and to work with neighboring jurisdictions to create safer lined regional

² Improving Solid Waste Management in Wyoming, a report to Governor Dave Freudenthal and the Wyoming DEQ, Citizens' Advisory Group on Solid Waste, September 16, 2004

landfills. The bill provides resources to local governments, in the form of direct grants and DEQ technical assistance, to help them determine the best and most cost-effective solid waste management solutions for their individual circumstances. The Joint Minerals Committee has raised a number of concerns about the impact the bill might have on Wyoming communities, and these concerns are discussed below.

IV. Issues raised by the Committee

A. How did DEQ arrive at its estimate that 65 Wyoming landfills will leak?

DEQ's original projection that 65 of Wyoming's 130 landfills will ultimately leak and require groundwater remediation was based on evaluation of two sources: a study of 224 California landfills, and an examination of the causes of Wyoming's leaking landfills performed at the University of Wyoming. We used California data because no other state in the arid west has performed such a comprehensive evaluation of leaking landfills.

We have reexamined both studies³. The good news is that when we use a more relevant subset of the California landfill data, that which corresponds directly with precipitation rates we experience in Wyoming, we believe we are justified in reducing our projection to 58 landfills, instead of 65. The bad news is that no matter how we review the California data, and the results of the Wyoming study, we cannot change our fundamental conclusion: more and more of Wyoming's unlined landfills will leak and contaminate our groundwater. We need to change the way we build landfills to prevent these problems from recurring in the future, and we need to fix the problems we've already created.

B. What's the cost of fixing Wyoming's leaking landfills?

DEQ's original cost projection showed that to deal with Wyoming's current leaking landfills, take actions to prevent future leaks at closed landfills, and address contamination likely to show up in the future, would require \$180 million. After careful consideration, the Citizens' Advisory Group recommended that the legislature should create a program of state assumption of remediation responsibilities, which is currently a local government responsibility.

This state remediation program would be patterned after the existing state program to clean up leaking underground storage tanks. The program, as described in the landfill bill, would operate at a level of \$6 million per year, for a period of 30 years. An additional \$1 million per year would be placed in a future regional landfill trust account, until the account reached \$20 million, to ensure that the state is able to remediate leaks from future lined regional landfills should they occur.

As part of our effort to respond to the Committee's direction to more clearly explain our cost projection, DEQ has reevaluated its \$180 million estimate⁴. As a result of this reevaluation,

³The reexamination is described in the memo: Estimated Scope of Landfill Impact Problem, Anderson, Dale; Wyoming Department of Environmental Quality, December 14, 2004.

⁴The revised estimate of the cost of remediation for 58 leaking landfills is described in the memo: Landfill

screening investigation costs have declined slightly, recognizing that some of the landfills where a screening investigation will take place already have some monitor wells in place. The cost of a full groundwater investigation has also been reduced for the same reason. Capping and gas mitigation costs have been recalculated based upon a more careful analysis of the number of acres likely to require capping, and on new cost data.

Although DEQ's new projection is that 58, not 65, landfills will ultimately need remediation, a more careful analysis considering the size (acreage) of the leaking landfills has resulted in no net change to the original cost estimate for remediation. DEQ also considered in this revised analysis new information that shows that 90 of the state's 130 landfills are located in areas of medium to low aquifer sensitivity, meaning that it could take much longer periods of time for leakage from these landfills to cause groundwater quality impacts. In these cases, we believe that lower cost remedial approaches would be justified.

Our new cost projection is that the 30-year program will cost \$174 million, or \$5.8 million per year. The new cost estimate is shown below:

Program element	Original Estimate	Revised Estimate
Screening investigations	\$3.3 million	\$2.0 million
Full groundwater investigations	\$10.9 million	\$7.8 million
Capping and gas mitigation	\$57.2 million	\$49 million
Remediation	\$105.4 million	\$105 million
DEQ administration costs	\$10.5 million	\$10.5 million
Total	\$187 million	\$174 million

C. What is the cost impact of the bill on communities?

Building landfills that are lined will cost more than digging a hole and throwing garbage in it, no matter how you cut it. In fact, we believe that for smaller Wyoming communities, the cost of building and operating a lined landfill would be unreasonable. Other states have reached this same conclusion. Even here in Wyoming, we have the example of Fremont County where six small rural landfills were closed in 1993, reducing the numbers of landfills serving the county from ten to four. Even with the cost of building transfer stations and hauling garbage, Fremont County's overall costs were reduced when it closed those landfills.

DEQ's evaluation of the cost impact of the bill is divided into two areas: costs for remediation, and costs to close unlined portions of landfills and begin disposal in lined regional areas⁵. We have not analyzed the cost impact of the bill with respect to recycling goals, which are required to be set in a rulemaking process (see 35-11-2001 in the proposed legislation). There is no doubt that implementing recycling systems costs communities money. The rulemaking process requires DEQ to consider the economic impacts on communities of meeting any specific recycling goals, and ensures that communities themselves will have a substantial role in developing those goals and ensuring that the economic impacts are reasonable.

Remediation Cost Estimate, Lydigsen, Jan; Wyoming Department of Environmental Quality, December 14, 2004.

⁵ A more complete discussion of DEQ's cost analysis methodology is described in the memo: Cost Impact of the Proposed Landfill Legislation, Doctor, Robert; Wyoming Department of Environmental Quality, December 13, 2004.

1. Remedial cost impact

We calculated remediation costs based upon the size of the landfill requiring remediation. Additionally, we used information on the location of Wyoming's 130 closed and operating landfills relative to aquifer sensitivity area to determine whether rapid (and costly) groundwater remedial measures would be needed (for landfills in areas of high aquifer sensitivity), or slower (and less costly) remedial measures would suffice. A rapid remedial measure would be an active system, like pumping contaminated groundwater out of the ground, treating it, and reinjecting. A slower measure would be to conduct groundwater monitoring over a long period of time to document the natural attenuation of contaminants. This latter option is only available where contaminant migration is slow, and there are no off-site receptors (wells) that could be impacted.

Using the range of remedial measures discussed above, we calculated ranges for groundwater remediation costs at each of five categories of Wyoming landfills. We assumed that remediation expenses would occur over a thirty year period, and we divided the total cost by the tonnage expected to be handled at each size category over that same thirty year period. For each category, this is the cost that a community with a leaking landfill is currently obligated to pay for remediation.

We also calculated the cost of paying fees specified by the bill. Recall that for all landfills the bill specifies two fees, to be calculated based on the number of people in the landfill's service area:

- A general statewide remedial fee which is equivalent to \$3.00 per person per year, for thirty years; and

- A regional landfill trust account fee, which is equivalent to \$2.00 per person per year, which is collected annually until the trust equals \$20 million (or for about 20 years).

In addition, if a community is unfortunate enough to have a leaking landfill, a third fee is specified:

- A supplemental leaking landfill fee, which is equivalent to \$2.50 per person per year, for ten years.

Since these fees are paid over different time intervals, we've converted the fee amounts to an equivalent cost to a community over a thirty year period (the same period expected for remediation expenses). For communities without a leaking landfill, the two fees, expressed as a cost per ton, are equal to \$4.33 per ton. For communities that also pay the supplemental leaking landfill fee, the three fees, expressed as a cost per ton, are equal to \$5.17 per ton.

The following figure shows the average community expenditures for remediation of a contaminated landfill in each size category, compared to the community's expenditures under the fee system as proposed in the landfill bill.

**FIGURE 1
REMEDIATION COST COMPARISON**

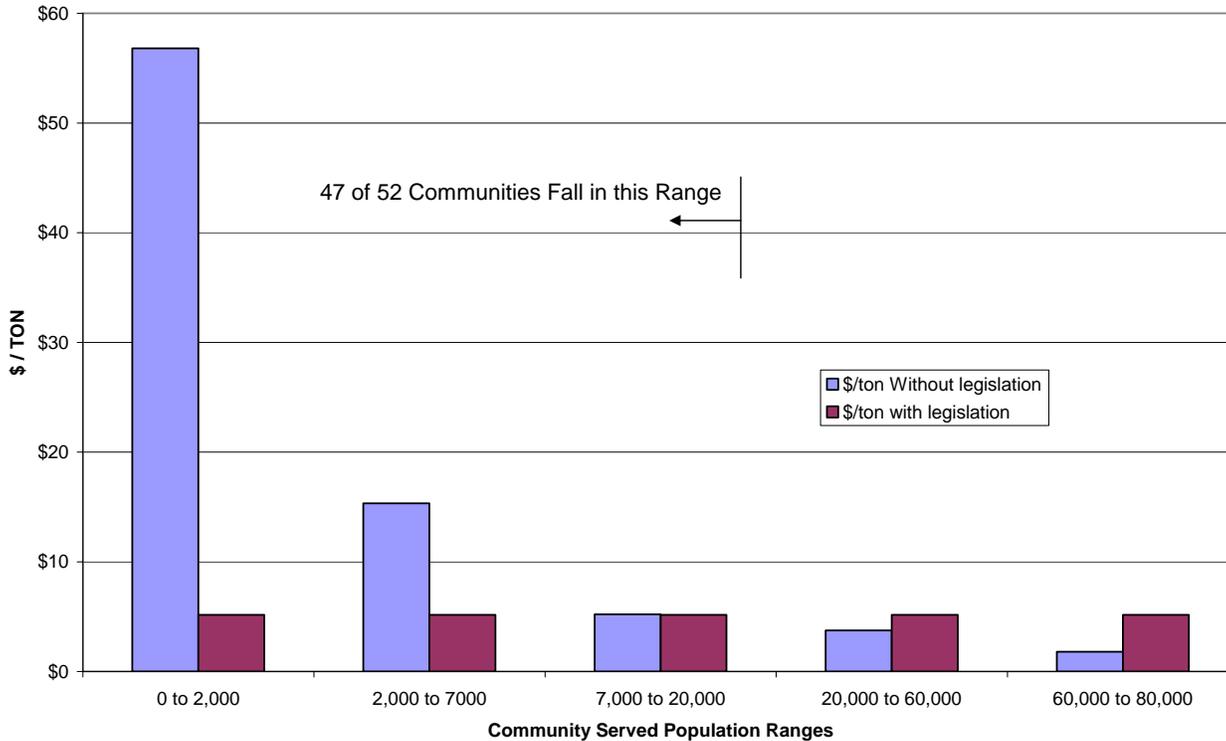


Figure 1 illustrates that the proposed legislation is extremely beneficial to communities with smaller landfills. 47 of the state's 52 operating landfills are in these smaller size categories. There are three landfills in the 'medium-large' and two in the 'large' size category. Paying the fees begins to become a 'wash' for landfills in these larger categories. Note that this latter conclusion is only correct if actual remediation costs for those larger landfills are no greater than the 'average' costs calculated by DEQ. The two largest cities, Casper and Cheyenne, have endorsed the bill as being beneficial to them.

2. Costs to communities of closing smaller landfills and hauling to a regional landfill.

DEQ has also calculated the costs of closing and capping the unlined portion of an existing landfill, building a transfer station, and hauling refuse to a larger lined regional landfill.

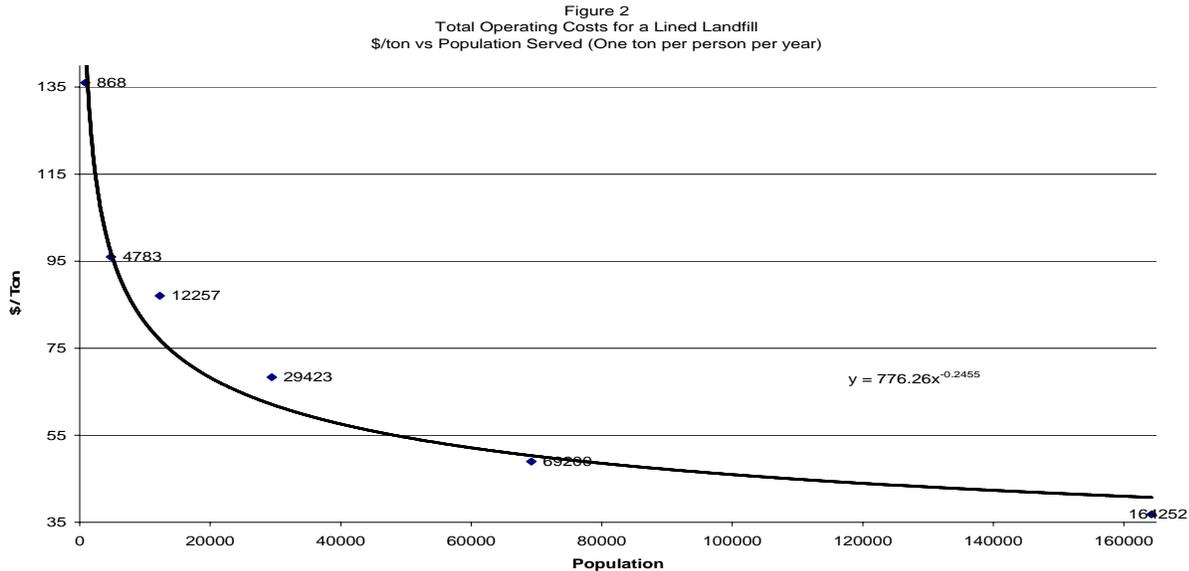
Since we found during our survey of current landfill operating budgets that most smaller landfills have not accumulated a closure cost reserve, we assumed that money to close would be borrowed from the State Revolving Fund, with an interest rate of 2.5 percent, and a 20-year payback period. The closure cost average we used in the analysis, \$95,000 per acre, was derived from actual closure and capping cost data we assembled from Wyoming landfills, and from review of capping cost data from other states. Capping costs vary widely, but to illustrate the cost impacts of the bill we believe that \$95,000 per acre is a reasonable estimate. We also assumed that construction of a transfer station would be financed, but since current rules don't allow SRF loans for this type of capital construction, we used the current State Land and Investment Board loan rate of 6 percent, with a 30-year payback period. Construction costs for

various sized transfer stations were derived from actual construction cost information collected from existing transfer stations in Wyoming.

Two additional pieces of information are needed to complete the cost analysis: the distance garbage must be hauled, and the disposal cost at the regional landfill where the garbage is disposed. DEQ collected transportation cost information from cities and counties in Wyoming who are currently hauling wastes to landfills in other communities. We used the following transport rates:

- \$6 per ton to haul to a landfill 25 miles away
- \$10 per ton to haul 50 miles
- \$21.50 per ton to haul 100 miles (all include round-trip mileage charges)

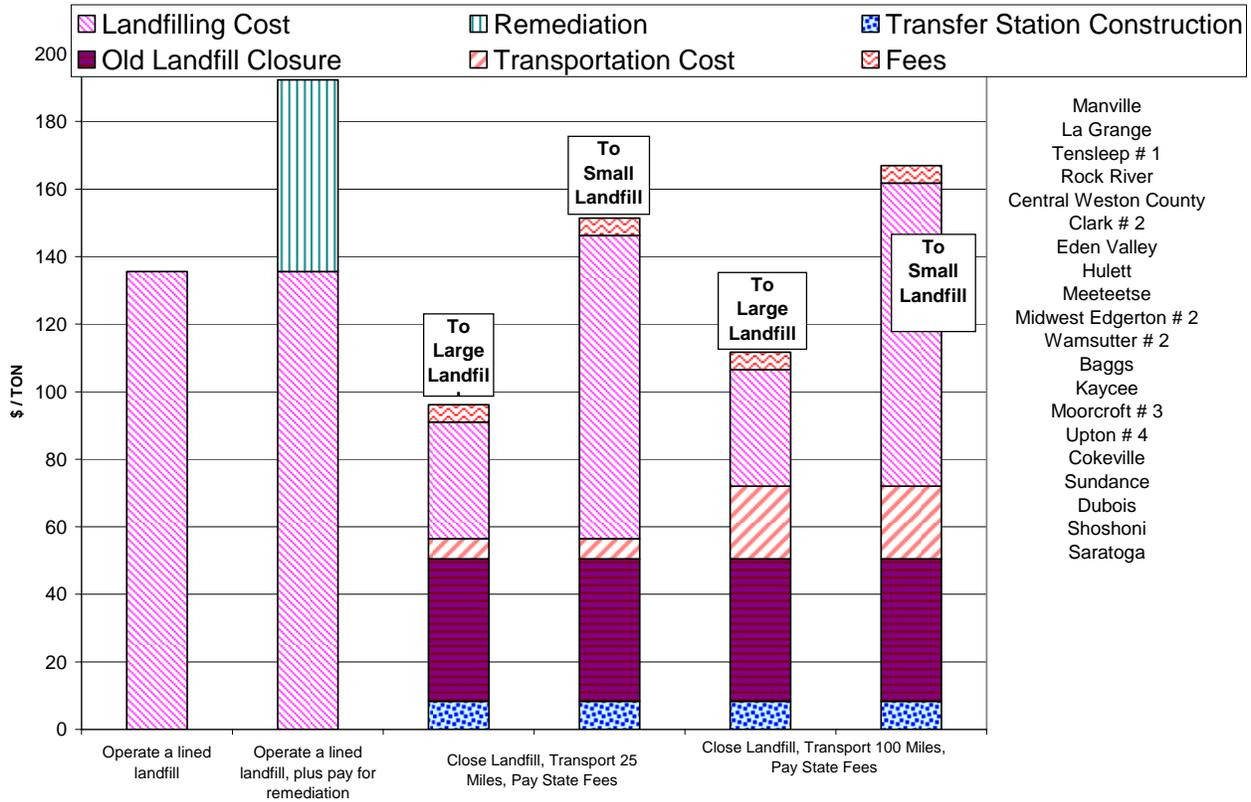
For disposal rates, we used costs derived from our survey of Wyoming landfill operating budgets and included engineering estimates for liner costs. We are indebted to the City of Casper for allowing us to use their rate model which allows prediction of landfill costs using various different assumptions about volume of incoming garbage. The graph below shows how landfilling cost varies with size of the landfill.



For the three smaller categories of landfills (very small, small, and medium), we calculated the costs of closing an existing landfill, building a suitably sized transfer station, and hauling to a regional landfill. For this paper, we are presenting a range of hauling and disposal costs. The lowest cost occurs when a community hauls a short distance (25 miles in our analysis) to a large landfill with low tipping fees (a landfill in the ‘large’ category). The highest cost occurs when a community hauls a great distance (100 miles in our analysis) to a relatively smaller regional landfill with higher tipping fees (a landfill in the ‘medium’ category).

The next three pages present our analysis of management cost options for Wyoming communities in three size ranges: those with landfills serving between 2 and 2,000 people; those serving between 2,000 and 7,000 people, and those serving between 7,000 and 20,000 people. Following those pages is a discussion of the likely economic impact of the proposed landfill bill on Wyoming’s five operating community landfills serving more than 20,000 people.

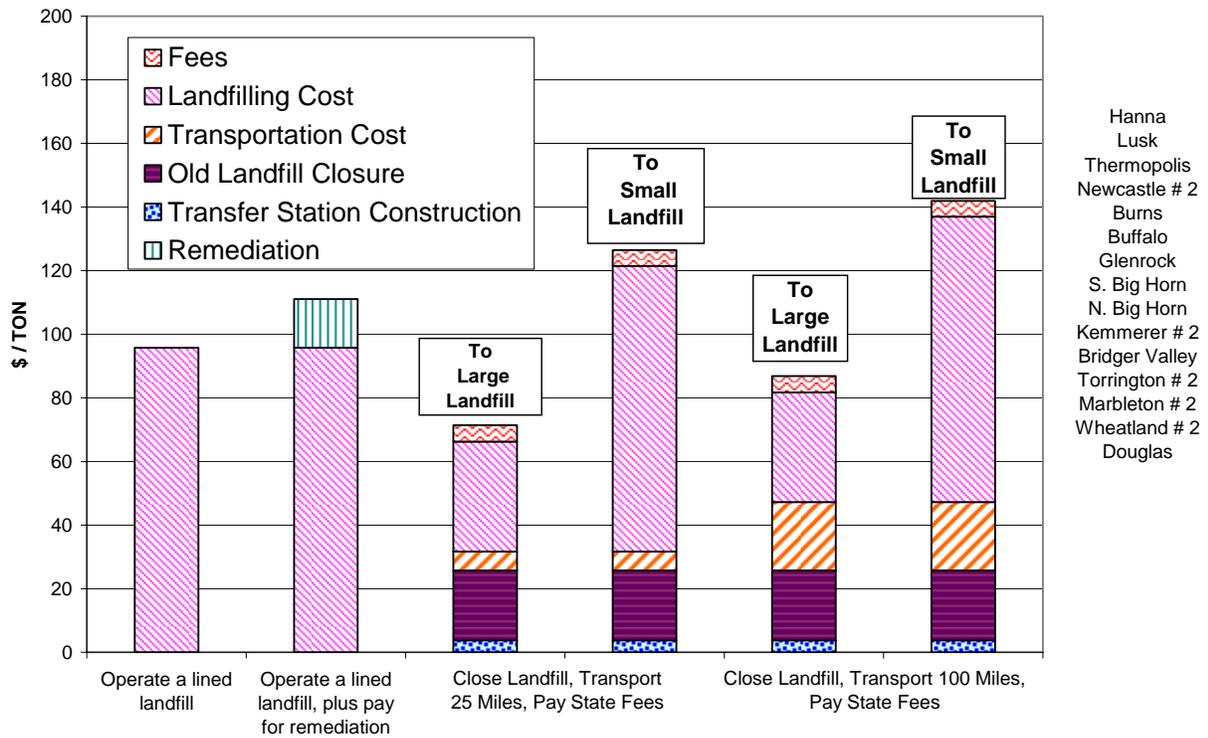
FIGURE 3
MANAGEMENT COST COMPARISON LANDFILLS SERVING COMMUNITIES WITH POPULATION LESS THAN 2,000



In this graph, the first bar shows the cost to continue as usual, but as a lined landfill--this is the cost that communities will likely incur whether or not the bill is passed. The second shows the costs if the community is unfortunate enough to have a leaking landfill, and must pay for remediation themselves (i.e., the bill is not enacted). The last four bars show the range of costs should the community elect to close their smaller landfill, pay the landfill fees envisioned by the bill, build a transfer station, and haul to a regional landfill—the first of these bars show the costs to haul 25 miles to a large landfill; the second to haul 25 miles to a medium-sized landfill; the third to haul 100 miles to a large landfill; and the fourth to haul 100 miles to a medium-sized landfill.

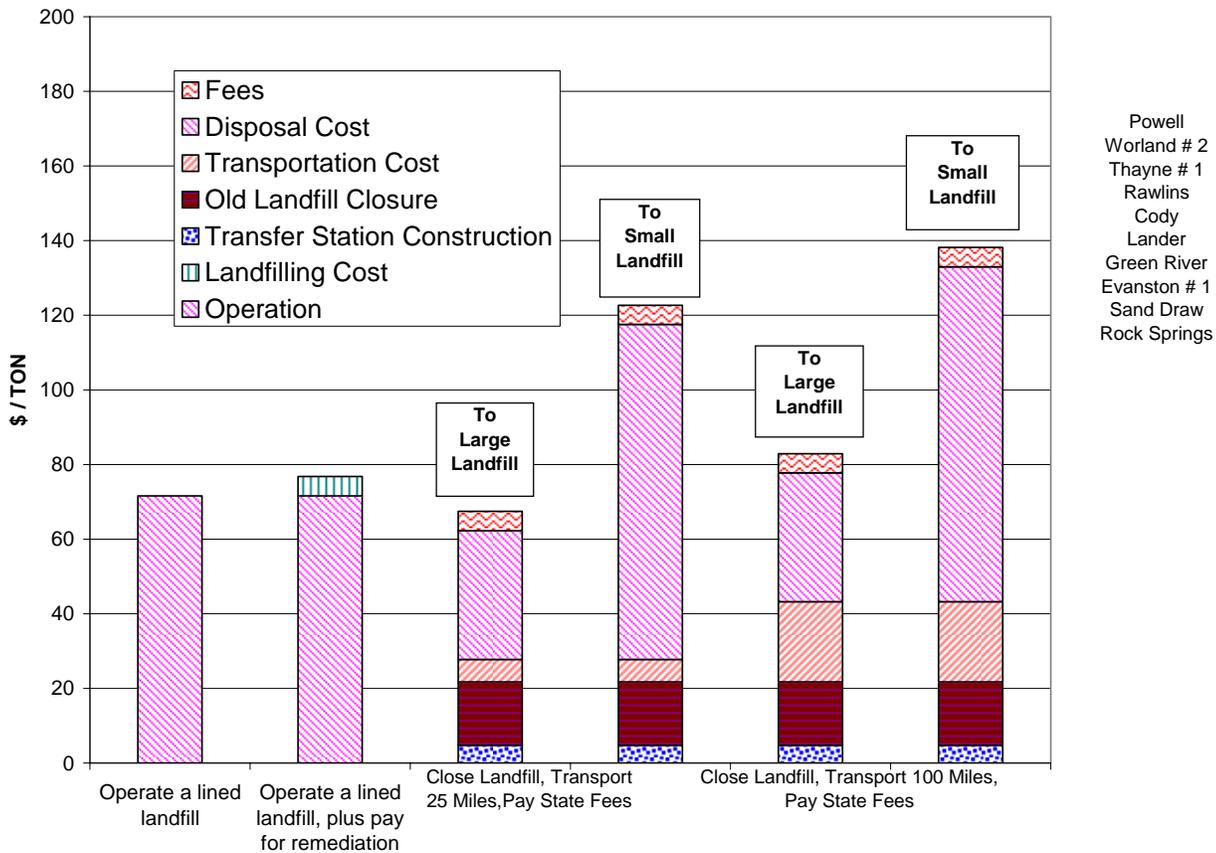
Communities in this size category, with landfills serving fewer than 2,000 people, have opportunities to realize a cost savings by transporting wastes to a larger regional landfill. The first bar in the chart above ('Operate Lined Landfill') shows that the average landfill in this size category costs about \$136/ton to operate, but that there are transfer options costing as low as \$95/ton ('Close Landfill, Transport 25 miles to Large Landfill, Pay State Fees'). Even if there isn't a large landfill within 25 miles, there are many other transfer options that cost less than keeping a smaller landfill open.

FIGURE 4
MANAGEMENT COST COMPARISON LANDFILLS SERVING COMMUNITIES WITH
POPULATION 2,000 TO 7,000



This chart, for communities with landfills serving populations between 2,000 and 7,000, makes a similar case. Keeping the average landfill in this size category operating costs about \$95/ton, and there are transfer options costing as little as \$70/ton. Note that there are also transfer options costing about \$140/ton, which are obviously not economic and should not be selected.

**FIGURE 5
MANAGEMENT COST COMPARISON LANDFILLS SERVING COMMUNITIES WITH POPULATION OF
7,000 TO 20,000**



Not all communities in this size category have the option to transport a short distance to a larger regional landfill (the low cost transfer alternative). For these communities, it probably makes sense for the community to keep their landfill open as a lined regional landfill, and to offer to accept wastes from neighboring communities as a way of lowering their per ton cost of managing wastes.

We must emphasize that some of the transfer options shown in all three of these charts (generally the option to haul long distance to a landfill with high tipping fees) cost more than keeping a community's landfill open. This cost comparison should illustrate that there are many options for communities to consider--some more economic than keeping a single-community landfill open, but some more costly. This is the reason that the bill includes a planning process, to provide resources to communities to help them select the best options for their individual circumstances.

No charts are presented for landfills in the upper two size categories (serving between 20,000 and 80,000 people), since their options to realize economies of scale by closing and transferring wastes to even larger landfills are limited. Casper's options are especially limited, since Casper is located some 200 miles from the nearest large city. DEQ believes that the benefit to be derived by such larger landfills is that they will remain open as regional landfills

and begin to accept wastes from communities who elect to close smaller landfills. Increasing the tonnage accepted by a landfill lowers its per ton operating cost, as is illustrated by Figure 2 above. Accepting wastes from surrounding communities offers an opportunity for Wyoming's larger landfills to stabilize the cost to provide safe (lined) waste disposal services for their own citizens, as well as provide a cost-effective waste disposal service for neighboring communities.

IV. Conclusions

1. Landfills produce toxic leachate--even those in arid and semi-arid environments. Twenty-one of Wyoming's 130 landfills are currently leaking and contaminating groundwater, and as many as 58 are projected to ultimately leak, requiring expensive remediation. Many of these landfills have numerous drinking and stock water wells located nearby.

2. Solid waste disposal costs for Wyoming citizens will significantly increase, unless something is done to mitigate those cost increases. These cost increases will be driven by the need for liners at Wyoming's currently operating landfills to prevent future leaks from contaminating groundwater. They will also be driven by the significant costs to communities to remediate leaks from current and closed unlined landfills.

3. The scope of the landfill cleanup obligation that currently rests with Wyoming's local governments, and by extension, the people of Wyoming, is staggering. DEQ now projects that statewide remedial requirements will cost local governments \$174 million over the next 30 years.

4. There are many solid waste management alternatives for local governments that make more sense economically than to keep a small landfill open. These alternatives take advantage of economies of scale that can be realized by closing smaller landfills, building transfer stations, and hauling refuse to larger lined regional landfills. Selection of alternatives needs to remain a responsibility of local government, but careful planning is needed to ensure that cost-effective alternatives are chosen. The landfill bill establishes a planning framework for local governments, and provides financial assistance to help pay for plan preparation.

5. To address the solid waste problems facing local government in Wyoming, a Citizens' Advisory Group comprised of city and county government leaders, local public works directors, consulting engineers, environmental group members, and others met over a nine-month period. The Group developed a thoughtful, reasonable approach, considering a wide range of interests, to address the problem of leaking landfills and to put in place a system to help local governments increase the diversion of solid wastes from landfills to recycling systems. That approach is embodied in the Community Landfill Remediation Act sponsored by the Joint Minerals, Business and Economic Development Interim Committee.