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# RURAL ECONOMY

**Waste Management Behaviour of Households:  
A Case Study of a Strike in Saskatchewan**

Fiona J. Salkie, Wiktor L. Adamowicz, and Martin K. Luckert

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## STAFF PAPER



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<sup>1</sup>Authors are, respectively, Research Associate, Professor, and Associate Professor, Department of Rural Economy, University of Alberta. Funding for this project from Environment Canada, Research Program on Economic Instruments for Achieving Environmental Objectives, A Green Plan Initiative is gratefully acknowledged.

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## **Waste Management Behaviour of Households: A Case Study of a Strike in Saskatchewan**

Canadians produced nearly 1 tonne of solid waste per capita in 1988 (CCME 1989). This level of solid waste production places Canada among the largest producers of solid waste per capita in the world. Due to decreasing landfill capacity, and the increasing cost of solid waste disposal, the Conseil canadien des ministres de l'environnement (CCME) established a national objective to reduce solid waste disposal in landfills to 50% of 1988 levels by the year 2000. A variety of economic instruments may be used to reduce total amount of waste generated, and change the proportion of waste that is discarded, by encouraging recycling and composting as an alternative to dumping in landfills.

While economic instruments are usually implemented by governments, in this paper we examine the impact of economic instruments that arose as a result of a strike by waste removal workers. Our analysis is based on a natural experiment that resulted when, from August 15 to October 19, 1994, there was no residential waste removal in Saskatoon, Saskatchewan because of such a strike. We first present a brief overview of some of the economic instruments that may be applied to solid waste collection. We then outline the research methods used in this study and describe the waste disposal system in Saskatoon, relating the effects of a strike to conventional economic instruments. This is followed by a discussion of the waste disposal/reduction systems available during the strike and the preliminary results. The results demonstrate that residents modified their behaviour in response to the strike and that some of these behaviour modifications continued after the strike. The paper concludes with a discussion of these changes and suggestions for future research.

### **Background Information**

Waste production can be broadly grouped into three types of waste: waste that is thrown out; waste that can be reused or recycled such as bottles, newspapers, containers, and old clothing; and organic material that is composted, garborated, or chipped. Households may divide their waste between these three options in different proportions, some choosing to throw out all their waste, while others may reuse/recycle or compost

significant quantities. Environment Canada (1992) describe a number of economic instruments that can be used to modify waste disposal by either reducing the total amount of waste produced, or changing the distribution of waste between the three end uses. These include: variable curb-side disposal fees; landfill tipping fees; differential landfill tipping fees; landfill surcharges with recycling rebates; virgin material taxes with recycling tax deduction; tradeable recycling permits; advanced disposal fees; and a variety of deposit refund systems.

A common economic instrument used to modify residential waste production is a variable curb-side disposal fee which can be either volume-based in which the fee for pick-up varies with the size and number of containers, or service-level based in which the fees vary depending on the service provided. Examples of service-level based user fees include ones in which the fee varies depending on the frequency of refuse collection or the location of pick-up (eg. backyard versus street). In these cases, lower service levels imply higher costs due to either non-market costs associated with waste accumulation, or the additional cost of moving waste from storage areas to the street for pick-up. Studies have shown that, in response to the implementation of volume-based or service-level user fees, the amount of waste discarded is reduced (Wertz 1976; Jenkins 1993).

In previous studies the own-price and income elasticities of waste disposal, and the relationship between a number of socio-demographic characteristics and waste disposal, were calculated. Wertz (1976) presented a model of the households' decision to produce waste; he calculated an income elasticity of waste production of 0.272 and a price elasticity of -0.15. Efav and Lanen (1979) found that the price of waste removal did not significantly affect the demand for waste disposal services. Jenkins (1993) calculated a price elasticity of demand for residential waste disposal services of -0.12 and an income elasticity of 0.41. She also identified a number of socio-demographic factors that were significantly related to the pounds of refuse discarded per capita per day including: the average temperature and precipitation, the percentage of the population between 18 and 49, and the population density, all of which were positively related to per capita

waste disposal; and the average household size which was negatively related to waste disposal. Morris and Holthausen (1994) developed a model to investigate changes in waste generated, disposed of, and recycled by households in response to a variety of economic instruments that may be applied to solid waste management. They used a simulation to calculate the relevant elasticities and welfare gains for the various policy options and found that the own-price elasticity of waste disposal and the cross-price elasticity of waste recycling, with respect to the cost of disposal, ranged from -0.15 to -0.60 depending on the price change. They also found that waste generation was quite elastic in response to changes in waste disposal charges with a cross-price elasticity ranging from 0.97 to 1.49, again depending on the charge implemented. Their results suggest that, in response to higher disposal costs, households will reduce the total quantity of waste they generate, however they will not change the distribution of waste between disposal and recycling. Thivierge (1992) reports that when a user pay program was instituted in Gananoque, Ontario residents became more aware of waste that they discarded and tried to reduce it by increasing the proportion of waste that was recycled and by changing their consumption patterns. In particular, purchases of products with non-recyclable, or excessive, packaging declined.

The effect of the garbage strike in Saskatoon on waste disposal resembled a number of economic instruments. The strike relates to a service-level based charge because garbage was not removed on a regular basis, and to a volume-based fee because, regardless of how homeowners dealt with their garbage, they incurred costs due to the strike. If they chose to allow waste to accumulate they faced non-market costs due to the unpleasant sight and aroma of stock-piled garbage, and the risk of pests. If they chose to remove it they either incurred the costs of driving it to the landfill themselves, or the cost of paying somebody else to remove the garbage<sup>2</sup>.

Most studies into the impact of various economic instruments on residential waste management have

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<sup>2</sup>The classified section of the StarPhoenix (1994d) lists operators providing private disposal services for a fee.

used cross-sectional data. In comparing between cities/regions that are provided with different municipal solid waste programs it is necessary to make a number of assumptions about similarities between the communities. In this study we avoid the problems associated with cross-sectional data by examining the results of a change within one community. Thivierge (1992) presents a description of changes that resulted when a user pay program was introduced to Gananoque, but he does not provide any statistical analysis of the changes. In this paper we use descriptive statistics to examine the effect of the strike, and relate this effect to the imposition of a user-pay solid waste disposal system.

### **A Case Study: Saskatoon, Saskatchewan**

#### *Methods*

A telephone survey was developed to identify waste disposal behaviour before, during, and after the strike, and to collect basic socio-demographic information. The survey is included as Appendix A. A telephone survey was selected because it could be implemented quickly; allowing respondents to be interviewed immediately after the strike while they were still able to remember their waste disposal behaviour before and during the strike. Telephone surveys also typically result in a higher response rate than mail surveys and are less expensive to deliver than in person interviews.

Telephone calls were made between November 17 and November 19, 1994 on a random basis using the Saskatoon telephone book. A total of 854 telephone calls were made, of these 169 respondents were deemed unqualified, Of the remaining phone calls, 506 (73.9%) resulted in completed interviews, 160 (23.4%) were uncooperative, and 19 (2.8%) were incomplete.

Interviewers first asked a number of questions to ensure the respondent was qualified to answer the questions. The respondents were then asked about the composition of their household waste and asked to proportion it between waste that is thrown out (TO); waste that is reused/recycled (RR); and organic waste (OW) that is composted, mulched, or garborated. They then indicated whether the composition and/or volume of waste generated changed either during or after the strike compared to the composition and volume prior to



the strike. This was followed by a number of questions intended to identify whether respondents changed their behaviour or actions as a result of the strike. The survey also collected a limited amount of socio-demographic information.

#### *Municipal Solid Waste Disposal Program in Saskatoon Prior to the Strike*

The municipal solid waste disposal program provided in Saskatoon is a flat fee program that is financed through municipal taxes (Prankiv<sup>3</sup>). The city of Saskatoon collects refuse weekly during the summer and every second week in the winter, they do not offer a curb side recycling or composting program. Residential waste makes up approximately 50% of waste in the landfill (Ashton<sup>4</sup>). Depending on a house's location, one of three types of waste pickup are used. The city provides 100 gallon garbage cans to individual households with no rear lanes and 300 gallon cans in areas with wide rear lanes; these cans are emptied mechanically. The 300 gallon cans are shared between four households. There are approximately 33 000 of the 300 gallon garbage cans, and between 15 000 and 16 000 of the 100 gallon garbage cans. The city only removes garbage that is contained within the 100 gallon bins; garbage in excess of this amount is not removed. However, when the bins are shared, the city cannot be certain whose waste is around the cans and, since they are legally responsible for garbage removal, they clean up around the cans approximately three times per year. Approximately 2500 households have rear lanes that are too narrow for mechanical pickup. In these areas householders are responsible for providing their own bins and waste is removed manually. The city also operates a landfill which takes residential waste on a fee per tonne basis. This study was restricted to households serviced by mechanical pick-up; 64% of the qualified respondents shared a 300 gallon bin with their neighbours and 36% used a 100 gallon bin.

When asked to proportion their solid waste production between the three categories of waste, over 65% of the respondents estimated that they threw out more than 50% of their waste and less than 11%

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<sup>3</sup>Personal communication with Richard Prankiv, Solid Waste Branch on November 1, 1994.

<sup>4</sup>Personal communication with Murray Ashton, Solid Waste Branch on September 11, 1995.

estimated that they threw out less than 20% of their waste (Table 1). The average composition of waste amongst respondents was: 57.3% TO, 28.5% RR, and 14.3% OW. Nearly half of the respondents, 47.3%, estimated that their garbage cans were full on a typical weekly collection day prior to the strike, and a further 20% indicated their cans were 3/4 full. Only 9.5% of respondents had cans that were less than 1/2 full. Most respondents reused or recycled some of their waste; only 8% felt that RR constituted more than 50% of their waste, and approximately 22% indicated that it made up no more than 10% of their waste. Although 50% of respondents said they had no OW, approximately 17% estimated that OW constituted more than 30% of their waste.

Table 1. Composition of Waste Prior to the Strike <sup>1</sup>

|           | Thrown Out |                   | Reused/Recycled |                   | Organic Waste |                   |
|-----------|------------|-------------------|-----------------|-------------------|---------------|-------------------|
|           | Frequency  | Percent of sample | Frequency       | Percent of sample | Frequency     | Percent of sample |
| 0         |            |                   | 26              | 5.1               | 253           | 50.1              |
| 1 - 10%   | 25         | 5.0               | 87              | 17.2              | 52            | 10.3              |
| 11 - 20%  | 35         | 6.9               | 102             | 20.2              | 40            | 7.9               |
| 21 - 30%  | 51         | 10.1              | 117             | 23.2              | 76            | 15.0              |
| 31 - 40%  | 49         | 9.7               | 73              | 14.5              | 42            | 8.3               |
| 41 - 50%  | 81         | 16.0              | 60              | 11.9              | 23            | 4.6               |
| 51 - 60%  | 37         | 7.3               | 14              | 2.8               | 7             | 1.4               |
| 61 - 70%  | 49         | 9.7               | 10              | 2.0               | 4             | 0.8               |
| 71 - 80%  | 83         | 16.4              | 13              | 2.6               | 7             | 1.4               |
| 81 - 90%  | 54         | 10.7              | 3               | 0.6               | 1             | 0.2               |
| 91 - 100% | 41         | 8.1               |                 |                   |               |                   |
| Mean      | 57.32%     |                   | 28.48%          |                   | 14.31%        |                   |

<sup>1</sup>Initial responses were continuous however data were categorized for ease of reporting.

### *Impact of the Strike*

Residents were forced to adapt their waste disposal habits during the strike to accommodate the alternative disposal services that were available. Alternatives included stock piling garbage, hauling garbage to a landfill, paying someone to remove the garbage, and modifying household behaviour in order to reduce either the total amount of waste produced or the proportion of TO. The city provided three temporary garbage depots at which wet kitchen garbage and disposable diapers could be deposited and city residents were advised to use one of two landfills in Corman Park for other garbage. The landfills in Corman Park are operated by the Rural Municipality of Corman Park and Loraas Disposal and charged \$4/half ton and \$4.50 minimum charge, respectively, for deposits during the strike (StarPhoenix 1994a). At the beginning of the strike the Spadina landfill, operated by the City of Saskatoon, was closed due in part to the volume of garbage dumped in front of the gates that made the landfill inaccessible, however it was reopened on August 26 for residential garbage and all charges were waived for the duration of the strike (StarPhoenix, 1994b/c). City managers also operated two mechanical garbage trucks throughout the strike and emptied most 300 gallon bins twice, and 100 gallon bins once. Residences not serviced by mechanical garbage pickup had no garbage removal during the strike. In addition to city services, a number of individuals advertised garbage removal, an advertisement in The StarPhoenix (1994d) cited \$1/garbage bag with a minimum charge of \$5 for this service. The effect of these waste disposal options may be similar to a combination of service-level and volume-based user fees. Households wishing more frequent pick-up than that provided by the city had to pay for private pick-up or incur the costs of hauling waste to a landfill themselves. Larger volumes of garbage may have cost more for private pick-up and may have required the use of a different, and potentially more expensive, vehicle to drive to the landfill or garbage depot.

Recycling programs in Saskatoon were not affected by the strike because they are not run by the city. The city provides approximately 120 depots (Shiley <sup>5</sup>) for newspapers and other paper products, that is then

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<sup>5</sup>Personal communication with Ed Shiley, Cosmopolitan Industries on August 1, 1995.

hailed by a contractor to COSMOS Industries (a sheltered workshop) for recycling. SARCAN (a division of SARC - Saskatchewan Association of Rehabilitation Centres) has a contract with the provincial government to operate four recycling depots to collect refundable beverage containers; these operate under the Litter Control Act. Refundable containers could also be donated to COSMOS who retained the deposit refund. Metal cans could be dropped off at one of two drop locations or taken directly to two companies for recycling, one company also accepted glass. Recycling was also available through Evergreen Recycling, a private recycling company that provided curb-side pick-up of paper, glass, plastic, metal, juice containers, and milk containers for a fee. This business closed on October 17 so was not available after the strike (StarPhoenix 1994e).

*Changes in Household Behaviour During and After the Strike*

Changes in Waste that is Thrown Out

When respondents were asked to compare the volume of garbage they threw out during and after the strike, to the volume before the strike, the majority said there had been no change (Table 2). However 24% felt that they threw out less during the strike, and 10% felt they threw out less after the strike. This compared to 2.2% who felt there TO increased during the strike, and nearly 4% who felt it increased after the strike.

Table 2. Change in Waste Thrown Out During and After the Strike, Compared to Before the Strike

|             | During the strike |                   | After the strike |                   |
|-------------|-------------------|-------------------|------------------|-------------------|
|             | Frequency         | Percent of sample | Frequency        | Percent of sample |
| Increased   | 11                | 2.2               | 19               | 3.8               |
| Decreased   | 121               | 24.0              | 52               | 10.3              |
| No change   | 373               | 73.9              | 432              | 85.9              |
| No response |                   |                   | 3                |                   |

Prior to the strike, 35% of the respondents had hauled waste to the landfill themselves and 5% had paid someone else to dispose of waste (Table 3). During the strike however, over 60% reported hauling their waste to the landfill and 13% paid someone else to. Approximately 25% of respondents hauled garbage to the landfill both prior to and during the strike (Table 4) and nearly one quarter of the respondents hauled garbage to the landfill during the strike who had not done so prior to the strike. Of 13% who reported paying to have waste hauled to the landfill during the strike, only 6% had done so previously.

Table 3. Frequency of Landfill Use <sup>1</sup>

|                                  | Prior to the strike |                   | During the strike |                   |
|----------------------------------|---------------------|-------------------|-------------------|-------------------|
|                                  | Frequency           | Percent of sample | Frequency         | Percent of sample |
| Hauled to landfill themselves    | 178                 | 35.2              | 246               | 62.9              |
| Paid someone to haul to landfill | 27                  | 5.3               | 52                | 13.3              |

<sup>1</sup>No data was collected on frequency of landfill use after the strike.

Table 4. Change in Frequency of Landfill Use

|   | Frequency | Percent of sample |
|---|-----------|-------------------|
| Number of people who hauled their waste to the landfill both during and before the strike                               | 129       | 25.5              |
| Number of people who hauled their waste to the landfill during the strike who had not previously done so                | 117       | 23.1              |
| Number of people who paid someone else to haul garbage to the landfill both during and before the strike                | 13        | 2.6               |
| Number of people who paid someone else to haul garbage to the landfill during the strike who had not previously done so | 39        | 7.7               |

A number of other methods of waste disposal were used both before and during the strike (Table 5). Before the strike 1% of respondents indicated that they stored some of their waste, however 8% stored some waste during the strike. Other common methods of waste disposal during the strike included taking it to work

(4%) and taking it out of town (3%). Seven respondents indicated that they had used some form of illegal dumping such as placing waste in construction bins, restaurant bins, or roadside garbage cans during the strike.

Table 5. Frequency of Using Alternative Methods to Dispose of Waste <sup>1</sup>

|                                  | Before the strike |                   | During the strike |                   |
|----------------------------------|-------------------|-------------------|-------------------|-------------------|
|                                  | Frequency         | Percent of sample | Frequency         | Percent of sample |
| Took to work for disposal        | 1                 | 0.2               | 19                | 3.8               |
| A friend took it                 | 1                 | 0.2               | 3                 | 0.6               |
| Stored at residence              | 6                 | 1.2               | 40                | 7.9               |
| Burned it                        | 2                 | 0.4               | 5                 | 1.0               |
| Took out of town <sup>2</sup>    | 4                 | 0.8               | 14                | 2.8               |
| Illegal dumping <sup>3</sup>     |                   |                   | 7                 | 1.4               |
| Took to private disposal company |                   |                   | 4                 | 0.8               |
| Dug waste into the ground        |                   |                   | 1                 | 0.2               |

<sup>1</sup>No data was collected after the strike.

<sup>2</sup>This category includes: took to the farm/acreage; took to small town dump; and took on business trips to other towns.

<sup>3</sup>This category includes putting garbage in a neighbours disposal bin, a roadside garbage bin, a construction disposal bin, an empty garbage bin, a restaurant disposal bin, or an apartment disposal bin.

#### Changes in Waste that is Reused or Recycled

Although the majority of respondents indicated that the volume of RR they generated did not change in response to the strike (Table 6), nearly 15% had more RR during the strike and 8% had more after the strike than before it. Approximately 3% of the sample reported less RR during and after the strike.

Table 6. Change in Waste Recycled Compared to Before the Strike

|             | During the strike |                   | After the strike |                   |
|-------------|-------------------|-------------------|------------------|-------------------|
|             | Frequency         | Percent of sample | Frequency        | Percent of sample |
| Increased   | 73                | 14.5              | 41               | 8.1               |
| Decreased   | 13                | 2.6               | 17               | 3.4               |
| No change   | 419               | 83.0              | 448              | 88.5              |
| No response | 1                 |                   |                  |                   |

#### Changes in Organic Waste

Few respondents reported any change in the volume of OW during or after the strike (Table 7). Although 13% of the respondents felt that their OW increased during the strike, only 7% felt it had increased after the strike. Three percent felt that they had less OW after the strike than they had before. However, of the 50% of the sample who had no OW prior to the strike, 6% reported some OW during the strike. After the strike 8% of the respondents who had not reported any OW prior to the strike had some OW.

Table 7. Change in Organic Waste Compared to Before the Strike

|             | During the strike |                   | After the strike |                   |
|-------------|-------------------|-------------------|------------------|-------------------|
|             | Frequency         | Percent of sample | Frequency        | Percent of sample |
| Increased   | 68                | 13.4              | 33               | 6.6               |
| Decreased   | 1                 | 0.2               | 15               | 3.0               |
| No change   | 437               | 86.4              | 455              | 90.5              |
| No response |                   |                   | 3                |                   |

## Changes in Behaviour

Total waste production, and the proportion of TO, can be reduced by modifying household actions and behaviour. Over 50% of the respondents felt that they had modified their behaviour or changed their actions in some way. Approximately 31% of the respondents had stopped bagging grass, 17% consciously purchased goods with different packaging, and 10% tried to reduce the amount of advertising materials and flyers they received (Table 8). Although only 2% of the total sample stopped using disposable diapers, 13.3% of those households using diapers stopped using disposables. Over 20% of the respondents had engaged in some activity during the strike that was intended to reduce the proportion of their waste that was TO (Table 9). Nearly 10% made more trips to newspaper depots or increased their household use of recycled containers during the strike. Nearly 9% increased their donations of goods to charity.

Table 8. Frequency of Changes in Behaviour to Reduce Waste Production During the Strike

|  | Frequency | Percent of sample |
|--|-----------|-------------------|
| Stopped bagging grass  | 155       | 30.6              |
| Consciously purchase goods with different packaging              | 84        | 16.6              |
| Attempt to reduce deliveries of flyers and advertising materials | 49        | 9.7               |
| Stopped using disposable diapers                                 | 10        | 2.0               |
| At least one of the above activities                             | 219       | 43.3              |



Table 9. Increases in Activities During the Strike, Compared to Before the Strike, That Would Reduce the Proportion of Waste That is Thrown Out

|  | Frequency | Percent of sample |
|--|-----------|-------------------|
| Trips to return newspapers to depot              | 48        | 9.5               |
| Trips to return beverage containers for a refund | 24        | 4.7               |
| Trips to take cans to a depot                    | 31        | 6.1               |
| Household use of recycled containers             | 50        | 9.9               |
| Donations of recycled goods to charity           | 43        | 8.8               |
| At least one of the above activities             | 114       | 22.5              |

#### Socio-demographic Data

Limited socio-demographic data were collected (Tables 10 and 11). Over 60% of the respondents were female. Although the survey questions did not ask about household income, it was possible to group respondents by mean household income with postal code area data provided by the census. Approximately 23% of the respondents lived in an area of the city where the average household income was \$35 152, just under 20% lived in an area with an average household income of \$49 619. More than 50% lived in an area with an average household income between \$41 000 and \$50 000.

Table 10. Gender of Respondent

|        | Frequency | Percent of sample |
|--------|-----------|-------------------|
| Female | 311       | 61.5              |
| Male   | 195       | 38.5              |

Table 11. Average Household Income by Postal Code Area <sup>1</sup>

|             | Frequency | Percent of sample |
|-------------|-----------|-------------------|
| \$32,549.00 | 65        | 12.9              |
| \$35,152.00 | 113       | 22.5              |
| \$38,452.00 | 2         | .4                |
| \$41,018.00 | 56        | 11.1              |
| \$43,864.00 | 90        | 17.9              |
| \$46,802.00 | 79        | 15.7              |
| \$49,619.00 | 96        | 19.1              |
| \$52,199.00 | 2         | .4                |
| No response | 3         |                   |

<sup>1</sup>Statistics Canada 1991

Household size varied from 1 to 9 members (Table 12). The majority of households, 29%, had two people in residence however 45% had 3 or 4 people living in the households. In over 64% of the households there were two people 18 years or older and 14.4% of households had children under two (Table 13).

Table 12. Number of People Living in Household

|     | Frequency | Percent of sample |
|-----|-----------|-------------------|
| 1   | 52        | 10.3              |
| 2   | 146       | 28.9              |
| 3   | 110       | 21.7              |
| 4   | 120       | 23.7              |
| 5   | 59        | 11.7              |
| > 5 | 19        | 3.8               |

Table 13. Number of People by Age in Household

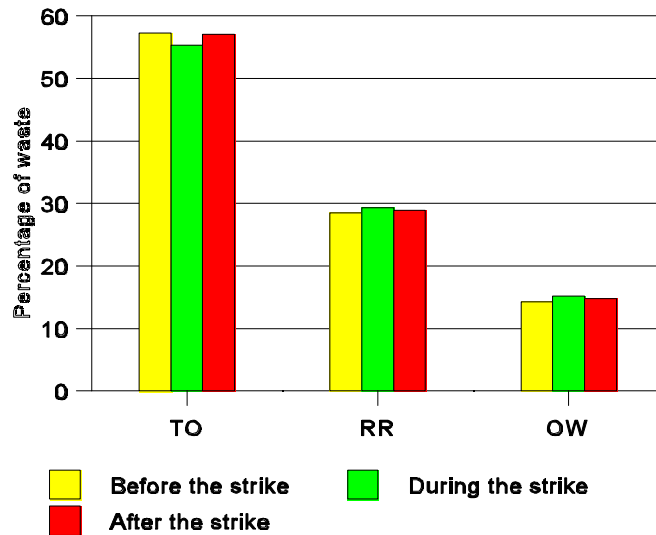
|         | 1             | 2            | 3           | 4            | ≥5          |
|---------|---------------|--------------|-------------|--------------|-------------|
| ≥ 18    | 47<br>(9.3%)  | 324<br>(64%) | 86<br>(17%) | 26<br>(5.1%) | 7<br>(1.4%) |
| 13 - 17 | 64<br>(12.6%) | 21<br>(4.2%) | 2<br>(0.4%) |              |             |
| 6 - 12  | 62<br>(12.3%) | 43<br>(8.5%) | 7<br>(1.4)  | 4<br>(0.8)   |             |
| 2 - 5   | 72<br>(14.2%) | 10<br>(2.0%) | 1<br>(0.2%) |              |             |
| Under 2 | 65<br>(12.8%) | 8<br>(1.6%)  |             |              |             |

## Discussion

Household waste management varied during the strike. One quarter of the respondents threw out less waste during the strike and 10% had less TO afterwards. Approximately 15% of respondents reported an increase in the amount of RR and OW during the strike, and about 8% reported more RR and OW afterwards. These findings suggest that the strike may have permanently affected some residents' household waste management; however, since the survey was administered between November 17 and 19 1994, only one month after the strike ended, long term trends were not evident. Furthermore, the composition of waste produced might have changed as a result of normal seasonal changes since the strike began in summer and ended in autumn. Regardless, the impact of the strike on total disposal at the landfill was likely small.

Individuals who indicated that their TO had changed were asked whether it decreased or increased by less than 10%, 10 - 25%, 25 - 50% or more than 50%. Using the mid-points of these categories it was possible to calculate that, among the respondents, the proportion of waste thrown out decreased by 2.0% during the strike and 0.2% after the strike (Figure 1). Extrapolating from these figures, taking into account that residential waste constitutes approximately 50% of waste deposited at the landfill in Saskatoon, the

Figure 1. Composition of Residential Solid Waste



strike only reduced the volume of waste deposited in the landfill by 1.0% during the strike and by 0.1% afterwards. The proportion of RR increased by 0.9% during the strike and 0.4% afterwards, and OW increased by 0.9% during and 0.5% afterwards.

A number of factors may explain why the strike did not have more impact on waste disposal. At the beginning of the strike residents were unsure of the duration of the strike, and may have assumed it would not last long. These expectations may have prevented householders from taking alternative actions to dispose of their waste. Furthermore, residents of Saskatoon were well prepared to deal with a strike since, prior to the strike, approximately 40% of the respondents had used waste removal options in addition to those provided through municipal services. This suggests that they may be familiar with alternative means of waste removal. Furthermore, since most bins in the city were emptied at least once by city managers, residents may have had their garbage removed before they needed alternative disposal. In addition, residents may have been able to compress their garbage enough that the city bins were sufficient. However, since half of the respondents

indicated that their bin was usually full prior to the strike, these theories cannot explain why only 25% of respondents discarded less waste. Perhaps the telling factor was the magnitude of the change. Since alternative garbage disposal was available for \$5 per load, respondents may have deemed this price increase insufficient to modify their behaviour.

Certain segments of the population may have been affected more by the implied price change. More affluent households, and smaller households, may be less affected by price changes than lower income families, and/or large households who may have gone to greater lengths to reduce their TO. Although a number of econometric models were developed to try to explain some of this variation in behaviour, relationships between demographic characteristics and waste disposal behaviour were not evident. This may be because much of the socio-demographic information that the literature suggests is important, for example income and age, was either aggregate for a region or was not available, whereas the data collected on behaviour and actions were at a household level.

Respondents modified their behaviour and actions in response to the strike. Over half of those interviewed felt that they did something different during the strike in order to reduce the amount of waste they threw out. It is of particular interest to note that over 15% of the respondents had changed their consumption habits in order to reduce the amount of packaging they purchased; this concurs with changes observed in the town of Gananoque (Thivierge 1992).

The parallels between common economic instruments used to modify household waste management and the strike suggest that the findings of this study may be used to support this literature. Previous research identified elasticities of waste disposal between -0.12 and -0.60 suggesting that households would reduce their TO in response to a rise in the cost of disposal. Our findings support this because, when the strike effectively increased the cost of disposal, one quarter of the households interviewed reduced the amount of waste that they threw out. Similarly, Morris and Holthausens' (1994) findings that the cross-price elasticity between RR and disposal prices was negative but less than 1 was supported because, in response to an

increase in disposal costs, nearly 15% of respondents increased the amount of RR.

Further research is required to quantify the impact of the strike on overall waste generation, and the type of waste produced. From a policy perspective it is important to know both the reduction of waste disposal that may be expected and the effect of policy changes on the amount of waste recycled. If the city operates a recycling program they generate income from the fee charged for waste pick-up and from the sale of recyclables. Thus a fee increase could potentially increase revenues directly from the disposal receipts, and indirectly through the sale of more recyclables. If, however, a fee results in more recycling of materials that have a negative net value to the city, the city may potentially lose money by instituting a variable fee <sup>6</sup>.

In future research, we intend to use a form of travel cost model to try to explain variations in residential waste disposal behaviour. By including the cost of travel to dispose of waste it may be possible to evaluate the effects of the strike in terms of the direct increase in costs for waste disposal. This, in combination with socio-demographic data, may explain differences in solid waste management observed across Saskatoon in response to the strike.

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<sup>6</sup>For a discussion of the optimal pricing of garbage and recycling see Kennedy and Laplante (1994).

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## Appendix A

### Saskatoon Municipal Solid Waste Survey

Hello, this is \_\_\_\_\_. I'm part of a research group funded by Environment Canada under the Green Plan. As I'm sure you are aware, from August 15 to October 19 normal municipal waste pick up was not available due to a city labour dispute. We would like to ask you a few questions to see if the waste disposal habits of Saskatoon residents were affected by this work action.

Your number was selected at random and your responses will be confidential.

Are you the person most qualified to answer questions about the waste disposal habits of your residence?

IF YES, CONTINUE INTERVIEW.

IF NO, ASK "May I speak to the person who is better able to answer questions on waste disposal by the residents in your household?"

REPEAT INTRODUCTION.

The interview should only take a few minutes of your time. You may withhold your response to any item if you wish. Okay?

1. Before we begin I need to know what kind of garbage pick up you have. Do you

#### READ ALTERNATIVES

- A. Share a 300 gallon bin that is provided by the city with your neighbours
- B. Have a 100 gallon bin provided by the city
- C. Provide your own containers for city pick up
- D. Live in an apartment or condominium

IF THEY RESPOND 'A' OR 'B' CONTINUE WITH THE SURVEY.

IF THEY RESPOND 'C' OR 'D' SAY SOMETHING LIKE "Thank you for your help with this survey, however I won't need to take anymore of your time because we are limiting our study to those households with municipal garbage bins." AND TERMINATE THE CALL



2. Solid waste can be lumped into 3 general types of materials. Items that are thrown away; items that are re-used or re-cycled such as bottles, newspapers, containers, and old clothing; and organic material such as vegetable material or yard waste that is composted, garborated, or chipped. Please think back to a typical week just prior to the work action - perhaps the last week of July. Thinking about the total volume of waste that you generally produced per week, what proportion of the volume of your household waste did you :

|                                 |   |
|---------------------------------|---|
| A. compost, garborate, or chip  | % |
| B. re-use or recycle            | % |
| C. throw out                    | % |
| SHOULD TOTAL APPROXIMATELY 100% |   |

3. Thinking first about the waste that you threw out, how full would your Garbage Can be on the weekly collection day? Would it be full, 3/4 full, 2/3 full, or how full?

1. full
2. 3/4 full
3. 2/3 full
4. 1/2 full
5. 1/3 full
6. 1/4 full

4. Before the work action, In addition to garbage that was removed by municipal garbage trucks, did you:

- A. Take some waste to the landfill yourself (CHECK YES IF A FAMILY MEMBER TOOK IT TO THE LANDFILL) YES \_\_\_\_ NO \_\_\_\_
- B. Pay someone else to take waste to the landfill YES \_\_\_\_ NO \_\_\_\_
- D. Do anything else to throw out waste? YES \_\_\_\_ NO \_\_\_\_  
 please specify: \_\_\_\_\_  
 \_\_\_\_\_

5. Now think about an average week **during** the work action, perhaps the last week of September. Do you feel that you threw out

- A. More waste than before the work action GO TO QUESTION 6
- B. Less waste than before the work action GO TO QUESTION 7
- C. Approximately the same amount of waste as before the work action GO TO QUESTION 8

6. By how much did the waste you threw out increase **during** the work action?

- A. increased more than 50%
- B. increased between 25 and 50%
- C. increased between 10 and 25%
- D. increased up to 10%

GO TO QUESTION 8

7. By how much did the waste you threw out decrease **during** the work action?

- A. decreased by 25 - 50%
- B. decreased by 10 - 25%
- C. decreased by up to 10%

8. How did you dispose of your household waste during the work action? Did you

- A. Take it to the landfill or a garbage depot yourself (CHECK YES IF A FAMILY MEMBER TOOK IT) YES \_\_\_\_\_ NO \_\_\_\_\_
- B. Pay someone else to dispose of your waste YES \_\_\_\_\_ NO \_\_\_\_\_
- C. Do anything else to dispose of your waste YES \_\_\_\_\_ NO \_\_\_\_\_  
please specify: \_\_\_\_\_  
\_\_\_\_\_

9. Now please think about your **current** waste disposal. Compared to a typical week **before** the work action, do you feel you now throw out

- A. More waste than before the work action GO TO QUESTION 10
- B. Less waste than before the work action GO TO QUESTION 11
- C. Approximately the same amount of waste as before the work action GO TO QUESTION 12

10. How much more waste do you now throw out than you did **before** the work action?

- A. increased more than 50%
- B. increased between 25 and 50%
- C. increased between 10 and 25%
- D. increased up to 10%

GO TO QUESTION 12

11. How much less waste do you now throw out than you did **before** the work action?

- A. decreased by 25 - 50%
- B. decreased by 10 - 25%
- C. decreased by up to 10%

IF NO RE-CYCLING/RE-USE IN QUESTION 2, GO TO QUESTION 18

12. You said that you re-cycled or re-used approximately \_\_\_\_\_% (TAKEN FROM QUESTION 2) of your household solid waste prior to the work action. Thinking back to a typical week **during** the work action, perhaps the last week of September, do you feel that you re-used or re-cycled

- A. more waste than before the work action GO TO QUESTION 13
- B. less waste than before the work action GO TO QUESTION 14
- C. about the same amount of waste as before the work action  
GO TO QUESTION 15

13. How much more waste did you re-use or re-cycle **during** the work action?

- A. increased more than 50%
- B. increased between 25 and 50%
- C. increased between 10 and 25%
- D. increased up to 10%

GO TO QUESTION 15

14. How much less waste did you re-use or re-cycle **during** the work action?

- A. decreased by 25 - 50%
- B. decreased by 10 - 25%
- C. decreased by up to 10%

15. Thinking about your **current** situation. Compared to a typical week **before** the work action, do you feel you now re-use or re-cycle

- A. More waste than before the work action GO TO QUESTION 16
- B. Less waste than before the work action GO TO QUESTION 17
- C. Approximately the same amount of waste as before the work action  
GO TO QUESTION 22

16. How much more waste do you now re-use or re-cycle than you did **before** the work action?

- A. increased more than 50%
- B. increased between 25 and 50%
- C. increased between 10 and 25%
- D. increased up to 10%

GO TO QUESTION 22

17. How much less waste do you now re-use or re-cycle than you did **before** the work action?
- A. decreased by 25 - 50%
  - B. decreased by 10 - 25%
  - C. decreased by up to 10%

GO TO QUESTION 22

18. You said that you didn't re-cycle or re-use your household solid waste prior to the work action. Thinking back to a typical week **during** the work action, perhaps the last week of September, do you feel you re-used or re-cycled more waste than before the work action?

- A. yes
- B. no GO QUESTION 20

19. During the work action, what proportion of the total volume of waste that your household produced did you re-use or re-cycle?

- A. Less than 5%
- B. 5 - 10%
- C. 10 - 25%
- D. 25 - 50%
- E. More than 50%

20. Thinking about your **current** situation. Compared to a typical week **before** the work action, do you feel you now re-use or re-cycle more waste than before the work action

- A. yes
- B. no GO TO QUESTION 22

21. What proportion of the total volume of waste that your household currently produces do you re-use or re-cycle?

- A. Less than 5%
- B. 5 - 10%
- C. 10 - 25%
- D. 25 - 50%
- E. More than 50%

22. IF NO COMPOSTING/GARBORATING/CHIPPING IN QUESTION 2, GO TO QUESTION 28  
You said that you composted, garborated, or chipped approximately \_\_\_\_\_% (TAKEN FROM QUESTION 2) of your household solid waste prior to the work action. Thinking back to a typical week **during** the work action, perhaps the last week in September, do you feel that you composted, garborated, or chipped
- A. more waste than before the work action GO TO QUESTION 23
  - B. less waste than before the work action GO TO QUESTION 24
  - C. about the same amount of waste than before the work action  
GO TO QUESTION 25
23. How much more waste did you compost, garborate, or chip **during** the work action?
- A. increased more than 50%
  - B. increased between 25 and 50%
  - C. increased between 10 and 25%
  - D. increased up to 10%
- GO TO QUESTION 25
24. How much less waste did you compost, garborate, or chip **during** the work action?
- A. decreased by 25 - 50%
  - B. decreased by 10 - 25%
  - C. decreased by up to 10%
25. Compared to a typical week before the work action, do you feel you **now** compost, garborate, or chip
- A. More waste than before the work action GO TO QUESTION 26
  - B. Less waste than before the work action GO TO QUESTION 27
  - C. Approximately the same amount of waste than before the work action  
GO TO QUESTION 32
26. How much more waste do you now compost, garborate, or chip than you did **before** the work action?
- A. increased more than 50%
  - B. increased between 25 and 50%
  - C. increased between 10 and 25%
  - D. increased up to 10%
- GO TO QUESTION 32

27. How much less waste do you now compost, garborate, or chip than you did **before** the work action?
- A. decreased by 25 - 50%
  - B. decreased by 10 - 25%
  - C. decreased by up to 10%

GO TO QUESTION 32

28. You said that you didn't compost, garborate or chip your household solid waste prior to the work action. Thinking back to a typical week **during** the work action, perhaps the last week of September, do you feel you composted, garborated or chipped more waste than before the work action?

- A. yes
- B. no GO TO QUESTION 30

29. During the work action, what proportion of the total volume of waste that your household produced did you compost, garborate or chip?

- A. Less than 5%
- B. 5 - 10%
- C. 10 - 25%
- D. 25 - 50%
- E. More than 50%

30. Thinking about your **current** situation. Compared to a typical week **before** the work action, do you feel you now compost, garborate or chip more waste than before the work action

- A. yes
- B. no GO TO QUESTION 32

31. What proportion of the total volume of waste that your household currently produces do you compost, garborate or chip?

- A. Less than 5%
- B. 5 - 10%
- C. 10 - 25%
- D. 25 - 50%
- E. More than 50%

32. Compared to the period **before** the work action, did the following activities increase, decrease, or stay the same in your household **during** the work action?

|   | Increase | Decrease | Stay the same |
|---|----------|----------|---------------|
| A. trips to take newspapers to a depot              |          |          |               |
| B. trips to return beverage containers for a refund |          |          |               |
| C. trips to take cans to a depot                    |          |          |               |
| D. household use of recycled containers             |          |          |               |
| E. donations of re-cycled goods to charity          |          |          |               |

33. During the work action did you purchase:

- A. a composter                                  YES \_\_\_\_\_ NO \_\_\_\_\_
- B. a garborator                                 YES \_\_\_\_\_ NO \_\_\_\_\_
- C. a trash compactor                         YES \_\_\_\_\_ NO \_\_\_\_\_

34. During the work action, did you

- A. Stop bagging your grass when you cut the lawn?                                  YES \_\_\_\_\_ NO \_\_\_\_\_
- B. Consciously purchase goods with different packaging?                                  YES \_\_\_\_\_ NO \_\_\_\_\_
- C. Attempt to reduce deliveries of flyers and other advertising materials?                                  YES \_\_\_\_\_ NO \_\_\_\_\_
- D. Stop using disposable diapers?                                  N/A \_\_\_\_\_ YES \_\_\_\_\_ NO \_\_\_\_\_

35. Has anything happened since July, other than the recent work action, which may have affected your waste disposal habits?

- A. Yes

What might have affected your waste flow during this time?

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- B. No

**DEMOGRAPHICS**

Finally I'd like to ask you a few questions about your household, this information will help us interpret the results of this research.

36. How many people, including children, live in your household? \_\_\_\_\_

IF ONLY ONE PERSON GO TO QUESTION 37

A. How many are 18 years of age or older? \_\_\_\_\_

B. What age are the residents under 18? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

37. What is the gender of the respondent to this survey?

A. male

B. female

38. What are the first 3 digits of your postal code? \_\_\_\_\_

Thankyou for your help with this research.