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IMPACT MANAGEMENT PRIORITIES AT WASTE FACILITIES: DIFFERENCES BETWEEN HOST COMMUNITY RESIDENTS' AND TECHNICAL DECISION MAKERS' VALUES*

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ABSTRACT

Host-community residents often oppose waste disposal facilities despite well intentioned efforts by technical decision-makers to address impacts. Conflicts over facility siting may stem from differences in impact management priorities between residents and technical decision-makers. Underlying these differences may be disparities in valuing facility impacts, as indicated by recent studies. This study tests for value differences by presenting three sets of impact management measures to host-community residents and technical decision-makers. Generally, residents more strongly than engineers favor a preventive approach despite higher costs. Preferences for specific measures are blurred, but residents follow a preventive rationale, while technical decision-makers consider cost effectiveness. As a result, engineers and planners must be aware of their own empirical tendency to undervalue impacts (losses) and overvalue benefits (gains) from waste facilities. Hence, technical decision-makers must take into account the higher sensitivity and resistence to changes among personally affected persons in selecting impact management measures for undesirable facilities.

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Waste disposal facilities are often opposed despite substantial efforts by the proponent and local governments to address the impacts on the host-community. The residents' resistance to a proposal that incorporates impact management measures may stem from differences between the types of impacts that concern residents and technical officials. Thus, residents may be more concerned about non-physical effects on community image and control than about purely physical impacts [1]. More fundamentally though, residents may generally value impacts more negatively and therefore may be less willing to accept changes that are perceived to be losses than are decision-makers who act as well intentioned agents for the host-community.

The purpose of this article is to test and compare directly affected residents' preferences for impact management with those of engineers acting on behalf of a local government to achieve the best possible outcome. Substantial discrepancies between the priorities set by these two groups indicate value differences between the two groups and explain the strong potential for conflict in siting waste facilities.

IMPACT MANAGEMENT SCENARIO

The typical municipal waste disposal system as defined here (see Figure 1) consists of an urban area as the waste generating center, from which the waste stream is hauled to a disposal facility in an adjacent community. There, the facility acts as the emitter and generates emissions that are discharged to and transported through air, water, soil to generate impacts in the host-community as the receptor. The cause of facility impacts in this system is therefore linked back through a sequence of cause-effect mechanisms to the source of the waste in the waste generating urban center. Possibly, the system could be extended farther upstream to include characteristics of urban-industrialized lifestyle, consumption, and production patterns. However, this system is defined here so that it consists of elements that are typically under the jurisdiction of municipal or county waste managers and engineers.

Four basic approaches to managing waste facility impacts in this system can be identified and defined (see Figure 1).

- Prevention is defined as a measure that reduces the cause of impacts before the emissions are generated; i.e., before the siting process begins or before the waste stream reaches the facility as the emitter.
- Control measures focus on impact reduction within the subsystem boundary of the waste facility or during the siting process; e.g., as engineered pollution control systems or as negotiated agreements.
- Mitigation comprises all measures to reduce impacts downstream from the facility and after the facility is built. Basically, this category includes remedial measures outside the compliance boundary; i.e., those which reduce impacts at the receptor rather than at the source. For example,

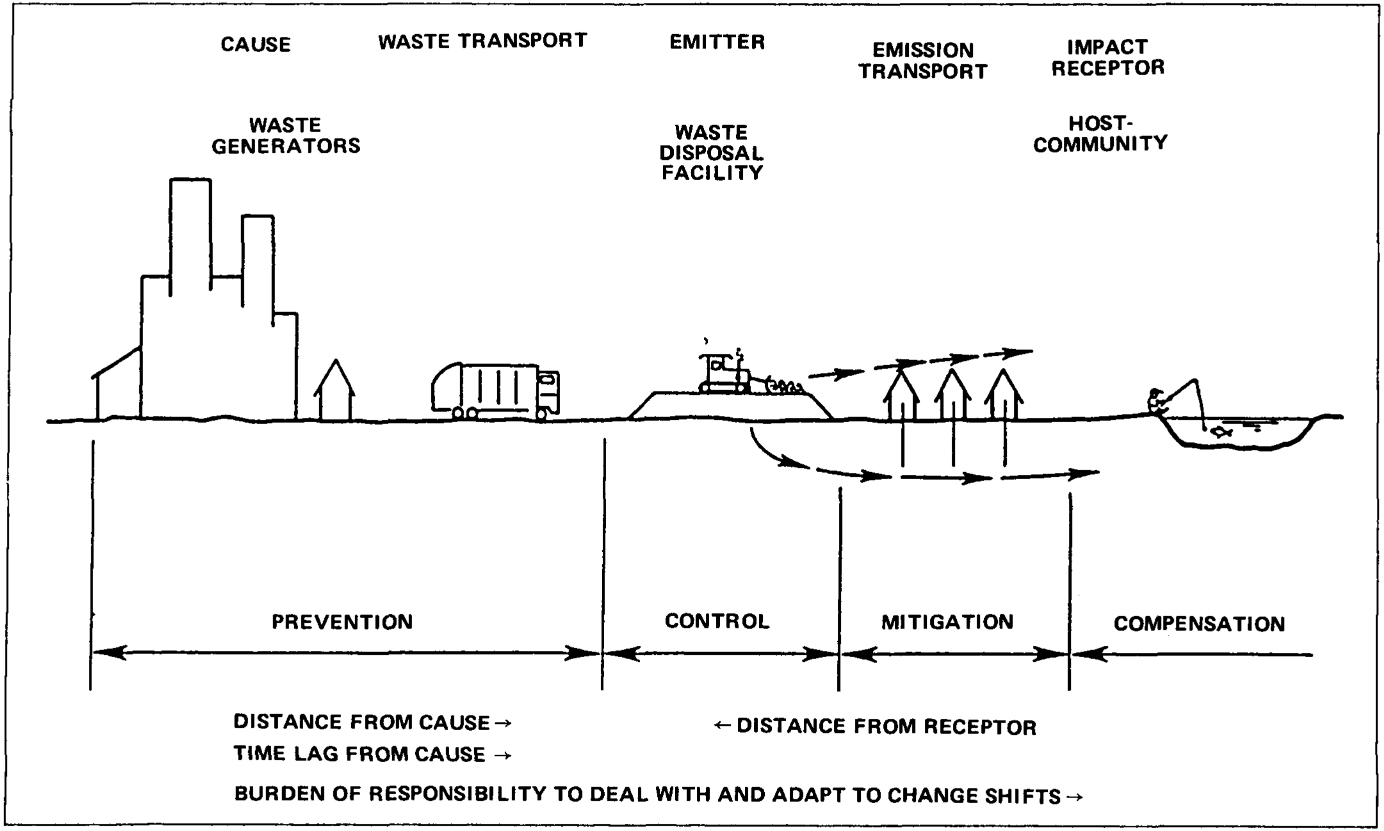


Figure 1. Waste disposal system and impact reduction methods.

groundwater remedial cleanup, etc. is a mitigation measure.

- Compensation measures are alternative benefits that are offered to replace losses through impacts. Compensation can be in-kind; e.g., as the provision of an alternate water source instead of contaminated groundwater wells, or as an alternate good; e.g., as money or as a different intangible good. The distinction between mitigation and in-kind compensation lies in the difference between the reduction of the specific impact as opposed to the replacement of a lost good by another good, albeit of the same type.

Although these four concepts are intuitive, the definition of the underlying dimension that describes the differences between these measures is not. Thus, the following explanation of the differences between the methods will result in a meaningful definition of the dimension as a priority for selecting impact reduction measures.

Intuitively, prevention is superior to control, because prevention reduces the impact at or close to the source and thus avoids subsequent impacts. Particularly in the waste disposal system, prevention addresses the cause outside the boundaries of the host-community, whereas control and mitigation limit the effects within the host-community. In the context of the waste disposal system, prevention changes the system closer to the cause of the impacts, i.e., at the waste generating source, and prior to the arrival of the waste stream or prior to construction of the facility in the host-community. From the host-community's perspective, the distance or the time lag from the cause to the impact reduction effect increases in the sequence of prevention, control, mitigation, and compensation, while the distance or time lag from the impact reduction effect to the community decreases in this sequence.

On a more abstract level, this sequence of measures follows a simple preventive rationale to first address the cause, the waste being generated and then brought to the facility (that is, into the community). Prevention implies that impacts are reduced by earlier intervention, control indicates direct intervention in the generating mechanisms, while mitigation occurs after emissions have been released. Finally, compensation takes effect when damage has occurred and can (often) only be replaced with other goods. This preventive sequence of methods coincides with the time dimension. With increasing distance and time lag between the cause and the efforts to reduce impacts, the gap increases between the waste generators as beneficiaries and the impacted residents as receptors of the losses. Thus, the distribution of benefits and costs becomes more unfair and the responsibility to deal with the problem moves further away from the generating source and closer to the receptor, the host-community.

Empirically, host-community and similar but unaffected control community residents have been shown to follow this preventive rationale in preferring prevention over control, mitigation and least preferring compensation remedies to make the facility more acceptable. Indeed, many respondents reject compensation as "bribes" or "buyouts" [1]. These findings show that affected people prefer to have impacts (losses) reduced rather than to be compensated by other benefits. They make decisions on preferences for impact management according to the predictions based on the prospect theory [2].

The issue addressed here is whether technical decision-makers who are acting with best intention for others exhibit similar values for losses and gains and follow the same rationale for impact reduction. Differences could indicate and explain conflicts among residents and well intentioned decision makers over the siting of waste facilities.

THEORY

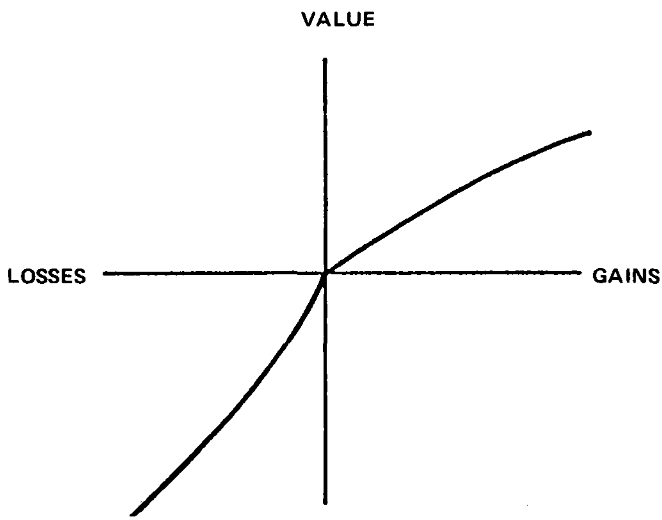
Differences between Residents' and Agents' Values

It is notable how frequently residents resist changes, even (seemingly) small ones. One explanation is to be found in the recently developed Prospect Theory [2, 3], because it shows and explains that directly affected people value losses from their reference point more negatively than they value gains positively. In other words, there is a value asymmetry that more heavily weighs losses (see Figure 2(a)). Moreover, respondents were also shown to separate and compartmentalize gains and losses on different dimensions [2, 4]. As a result, gains and losses on different dimensions are not readily traded off and will generally be resisted by affected residents because of the heavy value weighting of impact losses over compensation gains.

Agents are assigned the task of making decisions that affect other people but not themselves. Agents' values, as revealed in identical, parallel tests with directly affected respondents, show a significantly more symmetrical value curve with virtually equal values attributed to equal gain and loss increments [5] (see Figure 2(b)). Thus, in contrast to directly affected residents, agents are predicted to exhibit less change resistance and to more easily tradeoff gains and losses on different dimensions in making decisions that affect other people.

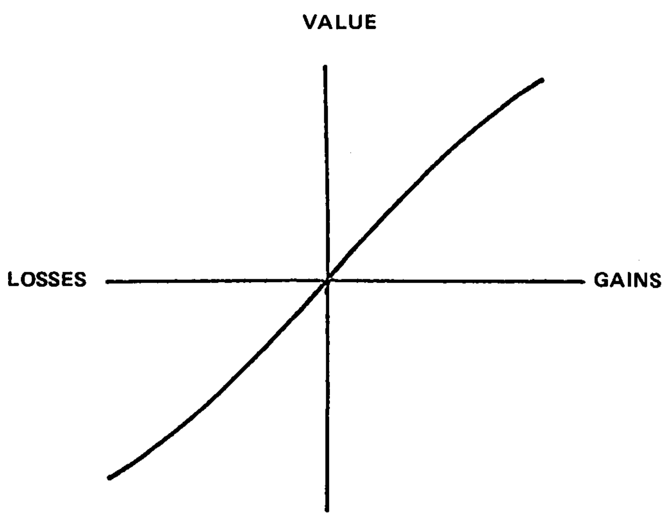
The differences in value curves may stem from residents' uncertainty about further ramifications that may result from the identified impacts [6]. Subsequent changes in local economy, community image, political control, etc. may occur or be accelerated as a result of the facility's physical impacts [1, 7]. The fear of additional changes may cause the negative premium in the evaluation of the facility's impacts.

Another reason for the value differences may arise from the necessity for affected persons to adapt to the changes and to cope with stress caused by the changes. Objects, events and activities that are highly stigmatized, such as waste, pollution and risk [7, 8] cause emotional and physical stress among affected residents [9, 10]. The negative value premium that residents attach to changes from their reference point may reflect their effort required to adapt to and to cope with the changes.



Source: Kahnemann and Tversky, 1979 [2].

(a). RESIDENT VALUE CURVE



Source: Marshall, et al., 1986 [5].

(b). AGENT VALUE CURVE

Figure 2. Resident and agent value curves for gains and losses.

Prediction

In the context of a waste disposal facility, residents are predicted to prefer measures that reduce impacts to a minimum over less effective and less expensive measures and over compensation with other goods. In contrast, agents are expected to more easily tradeoff impact reduction with costs and hence, more strongly consider cost-effectiveness; i.e., the ratio of impact reduction to cost, in their decisions. As a result, agents' preferences for impact management at waste facilities will significantly differ from the priorities set by host-community residents. This discrepancy can very likely result in opposition by the host-community to facilities that incorporate well intentioned impact reduction measures. Identifying systematic differences between these two groups of decision-makers can help facility proponents and government officials set priorities that will result in better host-community acceptance.

TEST METHODOLOGY

A set of four generic approaches was developed for managing waste facility impacts in a typical waste management system (see Figure 1). These four generic approaches were described and assigned basic per person cost ranges (see Table 1).

Table 1. General Impact Management Approaches for Waste Disposal Facilities

	Cost per Year per Urban Resident
Prevention	
Develop technical methods and policies to prevent the impacts by eliminating the cause of the problem before it occurs	$15 to 25
Control	
Develop and apply technical emission control methods in the facility	$10 to 15
Mitigation	
Develop remedial design methods to clean up impacts and/or replace damages that actually occur	$ 5 to 10
Compensation	
Make no changes to the system, but compensate impacts by paying money for damages	$ 3 to 5

Table 2. Landfill Leachate Impact Management Methods

	Effect in Reducing Emissions	*Cost in Taxes per Person*
Prevention		
Separate rotting organic matter from the garbage and treat it before placing them in the landfill to reduce leachate production	50% reduction	$11.00/year
Control		
Install bottom liner and top cover, collect and treat leachate to reduce emissions to groundwater	90% in first 15 years, 50% after that	$20.00/year
Mitigation		
Undertake leachate and groundwater monitoring on site and take remedial action to pump out and treat contaminated groundwater if necessary	Groundwater is contaminated in a small area for 10 to 15 years, gets better after that	$ 1.10/year
Compensation (in-kind)		
Monitor the water wells and connect those houses to other wells or to the city water supply free if their wells become contaminated from landfill leachate	Groundwater is contaminated but drinking water is safe	$ 0.10/year

In order to test preferences for common and salient waste facility impacts, sets of four specific impact management methods were selected and designed to correspond with the general approach definitions. Landfill leachate contamination and incinerator exhaust gas emissions were chosen to test preferences for physical impact management. Community image impact was chosen to test non-physical impacts. These impacts were shown to be of significant concern to host-community residents at actual facilities [1]. Four management options for leachate and air emissions were generically designed for typical facilities of 170,000 metric tons per annum capacity in Western Canada and the Pacific Northwest states [1]. The image management set comprises only three measures, because a prevention measure could not be reliably identified. Thus, control, mitigation and compensation are evaluated for image management. For the physical impact measures, engineering estimates of per person additional cost and reduction effect on impact levels were established. For image impacts, only the engineering costs could be reliably estimated (see Tables 2 and 3),

Table 3. Incinerator Exhaust Gas Emission Impact Management Methods

	Effects in Reducing Air Emissions	*Cost in Taxes per Person*
Prevention		
Separate the garbage and remove contaminants before burning to reduce the emissions to air	20% reduction	$21.65/year
Control		
Install the best available air filtration equipment to reduce air emissions in the exhaust air	10% reduction	$ 4.10/year
Mitigation		
Monitor air emissions in the air around the plant and reduce the amount of garbage that is burned if the measured emissions are significant	10%-20% if proven necessary	$ 3.20 to $ 5.90/year
Compensation		
Compensate homeowners with the dollar equivalent of 10% of property value	no risk to property prices	$ 2.50/year

because image impacts could not be reliably quantified. As a result, however, the incremental reduction effect to reduction cost ratio can be estimated by respondents for judging the physical impact management options, but not for the general approaches nor for the image impact options.

Since the general impact management approaches basically test preferences for preventive impact reduction, on one hand, with increasing costs up to $25 per person per year, residents are expected to more clearly prefer preventive impact management than agents who are more willing to tradeoff reduction effect for lower cost.

The set of leachate management measures at the landfill offers a choice between the following options:

- Preventive separation that (at 50% reduction) is not as technically effective as emission control, but is slightly more cost-effective;
- Emission controls that best reduce impacts, but are more costly and less cost-effective;
- Remedial mitigation that limits and eliminates groundwater contamination and prevents health risks;

Table 4. Community Impact Management Methods

	Cost in Taxes per Person
Control	
Design and landscape the site and surrounding buffer zone as a park with trees, ponds, golf course, playing fields, etc.	$0.50/year
Mitigation	
Zone area and provide incentives to encourage attractive development around the site	$0.10/year
Compensation	
Build an attractive facility in the community, such as a community hall or recreation center	$0.50/year

- In-kind compensation by providing an alternate supply of drinking water if necessary to eliminate health risks.

Based on the theory, the differences in preferences for this set of measures is predicted to be blurred, and possibly insignificant because neither preventive nor control measures are clearly superior by overall reduction effect or cost-effectiveness. However, if the preventive rationale determines choice, then the separation measure will be preferred; while both separation and emission control are predicted to be strongly preferred over the much less expensive mitigation and in-kind compensation.

In contrast, the measures at the incinerator consist of preventive separation that is most effective (at 20% reduction) but most costly (at $21.65 per person per year). Emission controls are less effective (at 10%), but much less costly (at $4.10 per person per year) and, hence, more cost-effective than prevention. Mitigation is equally effective and with compensation, in the same cost range as control. Thus, in this case, residents' and agents' are predicted to differ, with residents preferring prevention over control and agents preferring control and mitigation due to their better cost-effectiveness.

Finally, the image impact measures are identical for landfill and incinerator and vary in cost only between $0.10 and $0.50 per person per year. Thus, the preferences of residents and agents are predicted to follow the preventive rationale (control, mitigation and compensation).

Respondents were randomly selected in equal proportions from host-communities within two kilometers from three landfill and two incinerator sites in four metropolitan areas. The target sample size of twenty-five to thirty

Table 5. Survey Respondent Frequencies

	Residents		
	Count (N)	*Response (Percent)*	*Agent Decision-Makers*
Landfill	30	52	30
Incinerator	23	44	29
Totals	53		59

residents for each type of facility was selected so as to obtain, on average, six to seven entries per cell in each of the four cells in the residents' response column of a 2x4 cross-table. Due to missing responses among the incinerator community group, some modifications of cross-tables had to be made to assure that 75 percent of the cells had adequate expected frequencies of at least four [11]. The three sets of options were presented to residents of communities that host either landfills or incinerators (see Table 5).

These (potentially) directly affected host-community residents were asked to choose in sequence of declining preference the measures that, if implemented, would make the facility more acceptable. The per person costs and, where available, the reduction effects were pointed out; respondents were informed that the management measures would have no other side effects, positive or negative.

The respondent group to represent agents' preferences consisted of fifty-nine graduating civil engineering students at the University of Alberta. This group was chosen to reflect professionals who, as municipal engineers, are trained and likely to be making decisions on waste management as agents for the community and who are as yet little encumbered by organizational policies. The same three ranking tasks were put to the agents' group, albeit from the perspective of municipal engineers who are to make a recommendation to their council. Again, costs and reduction effects were pointed out. Respondents were then asked to briefly state their reasons for their priorities.

Responses from community and agents were coded and cross tabulated. The null hypothesis that the responses from the two groups show no significant difference was tested using the chi-square statistic for the 2x4 cross tables ($df = 3$). Thus, a chi-square value of at least 7.81 has to be obtained to reject the null hypothesis at the 95 percent interval. In some extreme cases though, the minimum expected cell frequencies were not reached, so where meaningfully possible, cells were collapsed to increase cell frequencies. Moreover, the non-parametric Mann-Whitney test was used to compare the ranking of measures. An underlying assumption necessary for these statistical tests, is, however, that the preference rankings distributions are independent. This is clearly not the case for responses within one group, where respondents rank four methods in each set. However, for cross comparisons of each subset of choices between resident and agent groups, independence can be assumed.

RESULTS

The preferences of community residents and decision agents are presented and compared here to determine whether there are significant differences.

The general preferences for facility impact management among both groups clearly follow the preventive rationale sequence of prevention, control, mitigation followed by distinctly least preferred compensation (see Table 6 and Figure 3). Thus, this distinct sequence of preferred impact management measures runs counter to the expected preference based on costs. These results thus tend to support the predicted preferences as derived from the prospect theory in that compensation is clearly the least preferred measure. Furthermore, the preferences reveal that the preventive rationale is predictably followed to rank the three impact reduction measures. However, residents' preferences rank the methods according to the preventive rationale more strongly and predictably than do agents, as indicated by the statistically significant differences for prevention, control and mitigation measures.

The preferences for specific management options for landfill emissions and incinerator emissions are more blurred, as expected, due to the tradeoffs of additional cost and effect factors. For the landfill, the residents' first preference shifts to prevention and control approaches, while agents now equally frequently choose prevention, control, and mitigation measures as their first choice. The differences, however, are not significant (see Table 7 and Figure 4).

At the incinerator, though, the ranking among residents more clearly follows the preventive rationale, while agents' ranks differ marginally from residents' in the first choice and highly significantly in their second and third choices by favoring cheaper control and mitigation (see Table 8 and Figure 5).

Thus, where the sequence of measures as indicated by effectiveness and location in the preventive rationale differ from that indicated by cost-effectiveness, agents tend to trade off impact reduction for lower costs. This is corroborated by the fact that while 70 percent of decision-makers at both sites mention addressing the cause for impacts at the source and avoiding future costs as their reasons for first choosing prevention as a general approach, 60 percent cite cost-effectiveness as their primary concern for their choices of specific impact management measures.

Finally, specific impact management options for intangible impact on the community image were submitted to preference ranking. Contrary to the physical impacts, the reduction effects were not identified because of the unquantifiable nature of community image. In contrast to the ranking of general approaches however, the costs for all three options here are virtually

Table 6. Preferences for General Impact Management Approaches

	Frequency of Respondents Who Pick the Measure in the Sequence of Choice			
	Residents		*Agent Decision-Makers*	
	Frequency Count	*Percent of Sample*	*Frequency Count*	*Percent of Sample*
Prevention				
1. Choice	45	87	39	66
2. Choice	6	11	9	15
3. Choice	1	2	8	14
4. Choice	0	0	3	5
Total	52	100	59	100
Statistic –	*df* = 3; Chi-square = 9.07; *p* = 0.028 – Significant			
–	Mann-Whitney U = 1190.5; *p* = 0.007 – Significant			
Control				
1. Choice	4	8	12	20
2. Choice	35	70	40	68
3. Choice	8	16	7	12
4. Choice	3	6	0	0
Total	50	100	59	100
Statistic –	*df* = 3; Chi-square = 6.7; *p* = 0.08 – Marginally Significant			
–	Mann-Whitney U = 1185; *p* = 0.031 – Significant			
Mitigation				
1. Choice	2	1	8	14
2. Choice	8	16	8	14
3. Choice	38	75	42	72
4. Choice	4	8	0	0
Total	52	100	58	100
Statistic –	*df* = 3; Chi-square = 9.2; *p* = 0.026 – Significant			
–	Mann-Whitney U = 1220; *p* = 0.043 – Significant			
Compensation				
1. Choice	2	4	0	0
2. Choice	4	8	2	3
3. Choice	2	4	1	2
4. Choice	42	84	55	95
Total	50	100	58	100
Statistic –	*df* = 3; Chi-square = 4.2; *p* = 0.24 – Non-significant			
–	Mann-Whitney U = 1290; *p* = 0.06 – Marginally Significant			

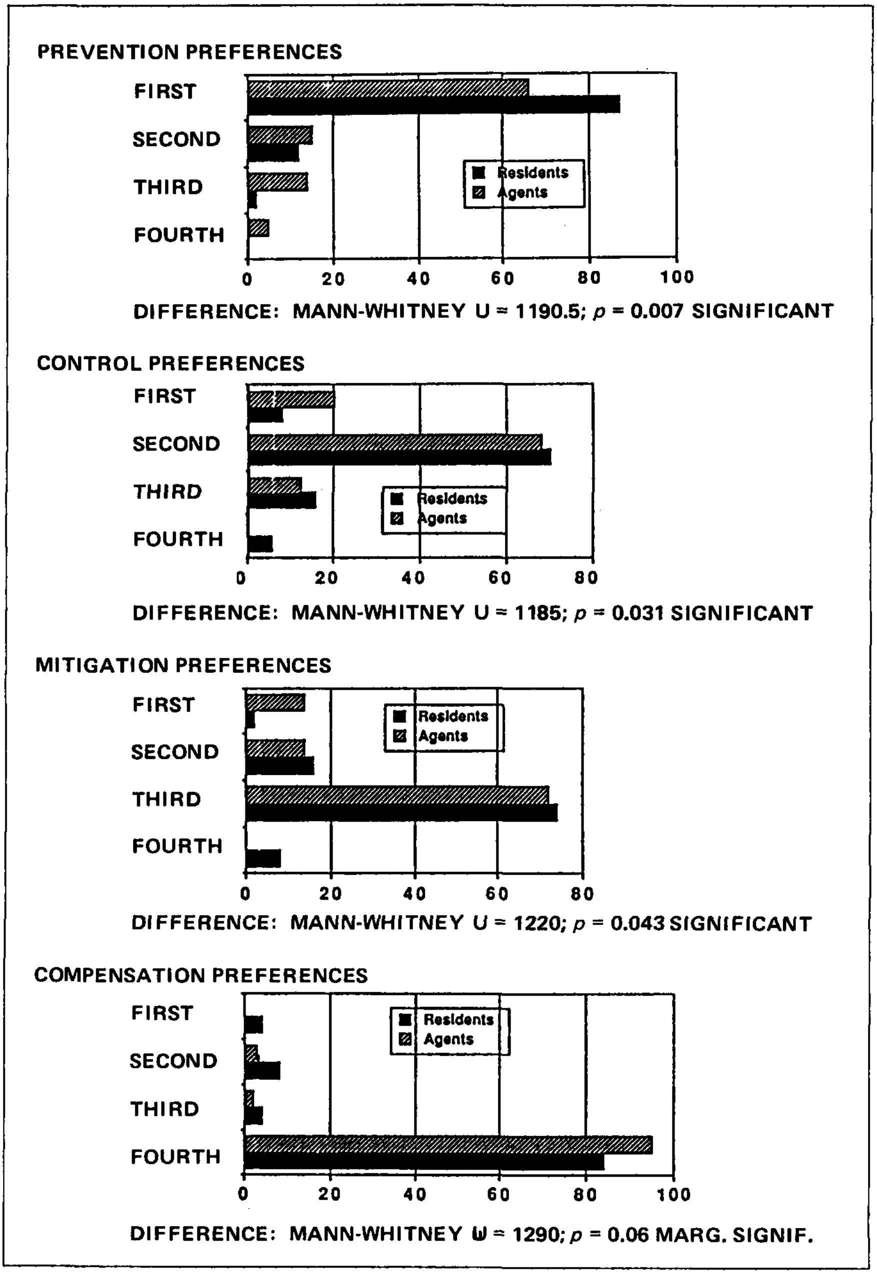


Figure 3. Preferences for general impact management approaches at waste facilities.

Table 7. Preferences for Landfill Leachate Emission Impact Management Methods

	Frequency of Respondents Who Pick the Measure in the Sequence of Choice			
	Residents		*Agent Decision-Makers*	
	Frequency Count	*Percent of Sample*	*Frequency Count*	*Percent of Sample*
1. Choice				
Prevention	10	40	10	34.5
Control	12	48	9	31
Mitigation	3	12	10	34.5
Compensation	0	0	0	0
Total	25	100	29	100.0
Statistic – *df* = 2; Chi-square = 3.92; *p* = 0.14 – Non-significant				
– Mann-Whitney U = 296.0; *p* = 0.155 – Non-significant				
2. Choice				
Prevention	14	56	11	37
Control	8	32	12	40
Mitigation	2	8	2	6
Compensation	1	4	5	17
Total	25	100	30	100
Statistic – *df* = 3; Chi-square = 3.4; *p* = 0.33 – Non-significant				
– Mann-Whitney U = 288.5; *p* = 0.11 – Non-significant				
3. Choice				
Prevention	1	4	5	17
Control	3	12	4	13
Mitigation	16	64	17	57
Compensation	5	20	4	13
Total	25	100	30	100
Statistic – *df* = 3; Chi-square = 2.52; *p* = 0.47 – Non-significant				
– Mann-Whitney U = 306.5; *p* = 0.19 – Non-significant				
4. Choice				
Prevention	0	0	3	10
Control	2	8	5	17
Mitigation	4	16	1	3
Compensation	19	76	20	69
Total	25	100	29	100
Statistic – *df* = 3; Chi-square = 5.85; *p* = 0.12 – Non-significant				
– Mann-Whitney U = 319.0; *p* = 0.34 – Non-significant				

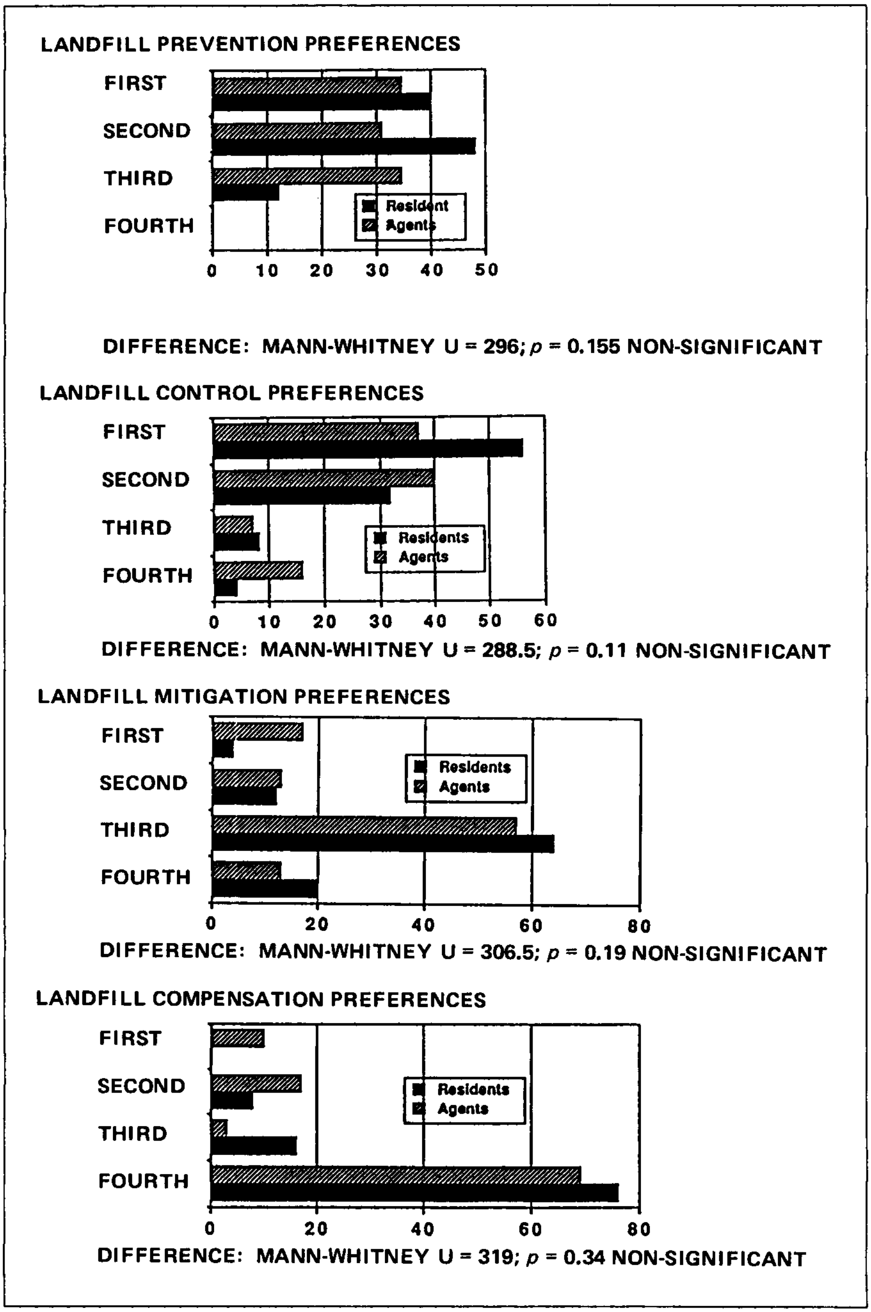


Figure 4. Preferences for impact management of landfill leachate emissions.

Table 8. Preferences for Incinerator Exhaust Gas Emission Impact Management Methods

	Frequency of Respondents Who Pick the Measure in the Sequence of Choice			
	Residents		*Agent Decision-Makers*	
	Frequency Count	*Percent of Sample*	*Frequency Count*	*Percent of Sample*
1. Choice				
Prevention	13	65	11	38
Control	5	25	12	41
Mitigation	2	10	6	21
Compensation	0	0	0	0
Total	20	100	29	100
Statistic – *df* = 2; Chi-square = 3.51; *p* = 0.17 – Non-significant				
– Mann-Whitney U = 208.5; *p* = 0.07 – Marginally Significant				
2. Choice				
Prevention	2	10	10	34
Control	9	45	17	59
Mitigation	9	45	2	7
Compensation	0	0	0	0
Total	20	100	29	100
Statistic – *df* = 2; Chi-square = 10.97; *p* = 0.0042 – Significant				
– Mann-Whitney U = 151.5; *p* = 0.0019 – Significant				
3. Choice				
Prevention	4	21	5	17
Control	6	32	0	0
Mitigation	9	47	20	69
Compensation	0	0	4	14
Total	19	100	29	100
Statistic – *df* = 3; Chi-square = 12.75; *p* = 0.0052 – Significant				
– Mann-Whitney U = 175.0; *p* = 0.016 – Significant				
4. Choice				
Prevention	0	0	3	10
Control	0	0	0	0
Mitigation	0	0	1	5
Compensation	19	0	25	86
Total	19	100	29	100
Statistic – *df* = 2; Chi-square = 2.86; *p* = 0.24 – Non-significant				
– Mann-Whitney U = 237.5; *p* = 0.095 – Marginally Significant				

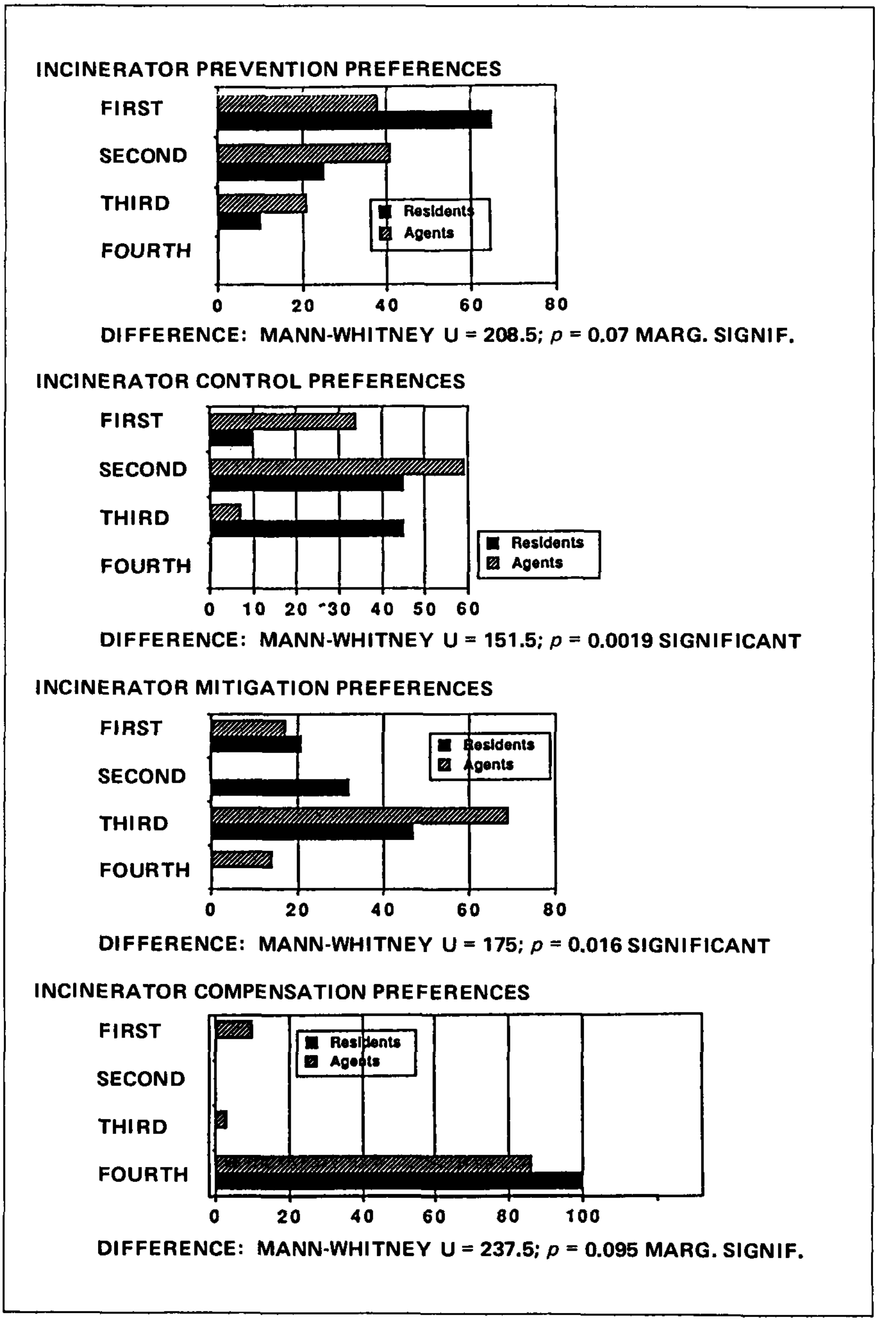


Figure 5. Preferences for impact management of incinerator stack emissions.

Table 9. Preferences for Community Image Impact Management Methods

	Frequency of Respondents Who Pick the Measure in the Sequence of Choice			
	Residents		Agent Decision-Makers	
	Frequency Count	*Percent of Sample*	*Frequency Count*	*Percent of Sample*
1. Choice				
Control	23	77	43	73
Mitigation	6	20	12	20
Compensation	1	3	4	7
Total	30	100	59	100
Statistic – *df* = 2; Chi-square = 0.46; *p* = 0.79 – Non-significant				
– Mann-Whitney U = 845.5; *p* = 0.65 – Non-significant				
2. Choice				
Control	7	23	14	24
Mitigation	14	47	29	49
Compensation	9	30	16	27
Total	30	100	59	100
Statistic – *df* = 2; Chi-square = 0.86; *p* = 0.96 – Non-significant				
– Mann-Whitney U = 863.0; *p* = 0.84 – Non-significant				
3. Choice				
Control	0	0	2	3
Mitigation	10	33	18	31
Compensation	20	67	39	66
Total	30	100	59	100
Statistic – *df* = 2; Chi-square = 1.07; *p* = 0.59 – Non-significant				
– Mann-Whitney U = 870.0; *p* = 0.87 – Non-significant				

identical at $0.10 to $0.50 per person per year. Under these circumstances, the residents and agents preferences are again similar, in that both groups prefer control measures over mitigation and compensation (see Table 9 and Figure 6). Thus, when cost-effectiveness is not readily determinable, then the agents tend to follow the preventive rationale as do the residents.

SUMMARY AND CONCLUSIONS

Directly affected residents are predicted by theoretical considerations to value negative impacts more heavily than positive changes. Hence, host-communities are likely to resist changes because losses loom larger than gains. In

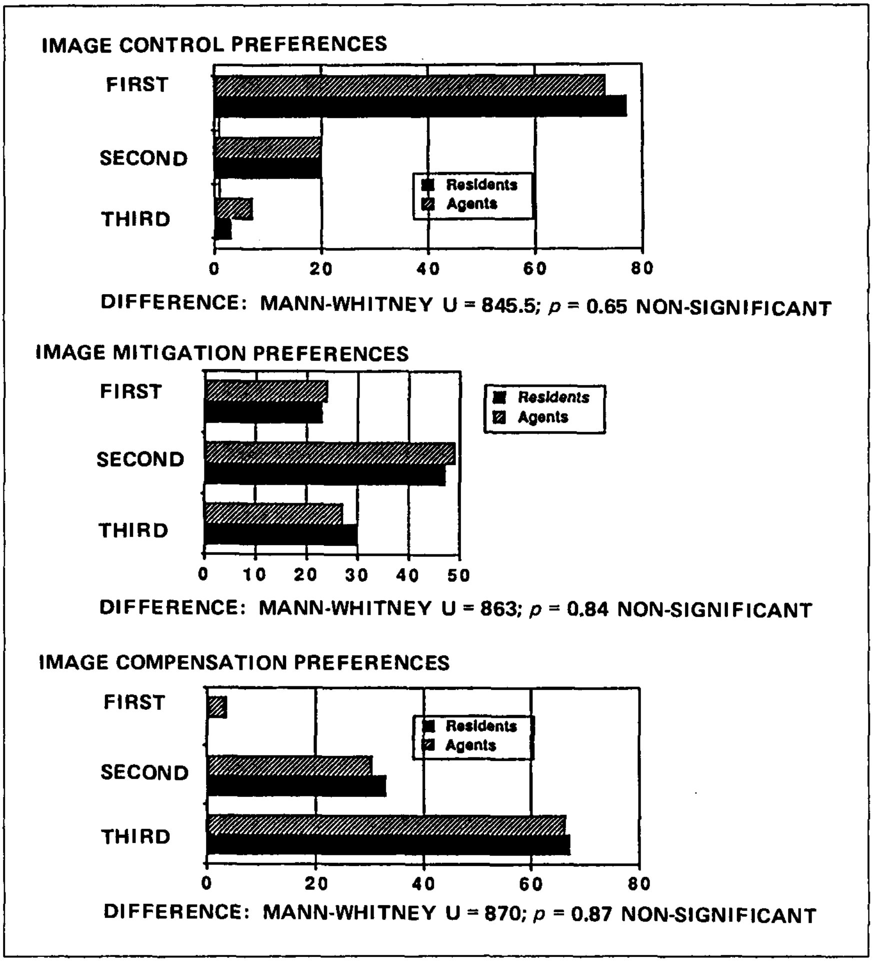


Figure 6. Preferences for management of image impacts at waste facilities.

contrast, decision-makers acting as well intentioned agents in the best interest of affected residents value positive and negative changes more equally. As a result, conflicts can occur in setting priorities for impact management in siting waste facilities based on value differences, even when the set of facts about facility impacts is given and agreed on.

Although the results show that both residents and agents generally follow a preventive rationale for setting priorities despite higher costs, residents do so significantly more strongly than technical decision-makers. Hence, technical decision-makers weigh more heavily the additional costs than do residents.

When sets of specific impact measures are given with specific costs and quantified reduction effects the agents are swayed more strongly by considerations of cost-effectiveness to abandon the preventive rationale. In contrast, residents are less willing to tradeoff preventive and highly effective impact reduction methods for lower costs to themselves. This shows that agents value the impact reduction increments less than the residents. These results thus corroborate the hypothesis that affected residents value the impact losses more heavily than the agents. Notwithstanding these differences, though, both groups consider compensation the least desirable impact management method despite the substantially lower costs for this method. Many respondents identify compensation as a "bribe" or "buyout" and outright reject it. However, for unquantifiable impacts where the cost difference for specific methods is small, both residents and agents again follow the preventive rationale.

In conclusion, directly affected residents and agent decision-makers are likely to set different impact management priorities because of their discrepant values they attach to losses and gains caused by waste facilities. As a result, agents will basically tend to favor more than residents projects that cause changes. Agents may tend to select control and mitigation measures rather than prevention measures in contrast to the residents. The potential for disparity is particularly pronounced in cases where cost or cost-effectiveness considerations run counter to the preventive rationale by not addressing the impact at the source, or do not result in maximum impact reduction.

Conflict may therefore occur because of differences in underlying values even when both groups are presented with and agree on the facts about the waste facility and its impacts. Whereas directly affected decision-makers tend to consistently use a simple, preventive rationale and hardly consider cost differences or cost-effectiveness, agents are less likely to follow the preventive rationale but rather decide on specific cost-effectiveness criteria. Where specific costs and technical information are available, agents use it to modify their choices and implicitly undervalue negative impacts compared with residents. This shift is expected to be reinforced in real decision scenarios by agents' better access to additional technical and cost information that may result in information bias [12], whereby additional information is interpreted to emphasize preformed opinions, regardless if the information is relevant.

IMPLICATIONS FOR FACILITY SITING AND IMPACT MANAGEMENT

The discrepancy between residents' and agents' values can create the potential for conflict. Hence, environmental engineers and planners who act as agent decision-makers need to take into account that directly affected persons discount gains and weigh negative impacts more heavily. Thus, agents cannot necessarily rely on their own weighting criteria in making decisions that affect others, particularly where cost-effectiveness and the preventive rationale or impact reduction conflict. In these cases, agents may consciously modify decision weights by applying a negative premium to losses and discounting gain values, for example in early project screening stages. Alternatively, agents need to obtain and incorporate value judgments of personally affected persons in determining method and degree of impact management. These efforts must be made in early design stages, when impact reduction methods can be freely selected according to expressed preferences.

Further, agents must avoid making implicit tradeoffs between gains and losses on different dimensions, because personally affected people do not readily accept such transactions; e.g., as replacement water supplies, community halls, or property value guarantees [13].

Agent decision-makers must be aware of their own biases, possibly caused by their information advantage that may lead them to reinforce their own value judgments with irrelevant information [12].

Finally, the negative premium applied to changes may be reduced if agents can first acknowledge resident concerns, then, tangibly and visibly address issues, thirdly, provide residents with some form of control or influence over the process, and finally, offer residents successful coping mechanisms to deal with the stresses caused by changes.

By taking residents' values into account in determining impact management priorities and by offering support to deal with changes, well intentioned technical agents can manage the change process to avoid conflicts and achieve better community acceptance.

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