National Indigenous
Fire Safety Council Project

Projet du conseil national
autochtone de la sécurité-incendie

COST-BENEFIT DECISION TOOL

To prevent fire risk for First Nations Communities

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INTRODUCTION AND OVERVIEW

The paper begins by providing a brief overview of the current situation for fire risk and First Nations communities in Canada. This context is then used to lead into a discussion of the potential contribution that research findings can make to building-in a sustainable approach to reducing fire-related risk on First Nations communities. A decision-making tool is introduced that builds on existing research and practice to help determine the likely costs and benefits of commitments to fire prevention (in the form of smoke alarms and residential sprinkler systems) and fire suppression (in the form of firefighting resources and Mutual Type Service Agreement – MTSA) strategies. Following that, two worked-examples of the decision-support tool are provided, demonstrating the capacity decision-makers have to manipulate the tool's assumptions to best-fit their specific budgetary and safety requirements. Finally, a general limitations statement about the use of this tool and some additional fire-prevention reference resources are detailed.

FIRE RISK AND FIRST NATIONS COMMUNITIES

The disproportionately high risk of fire-related casualty in First Nations communities has been documented since at least 2007, when the Canada Mortgage and Housing Corporation reported that the, "First Nations per capita fire incidence rate is 2.4 times the per capita rate for the rest of Canada. The death rate is 10.4 times greater; the fire injury rate is 2.5 times greater; and the fire damage per unit is 2.1 times greater." As explained by Huesken et al. (2020, p.5), "The heightened risk for fire-related injuries and deaths among Indigenous people in Canada and beyond is well documented even in the absence of Canadian on-reserve fire-related data collection."

In response to this situation, the Joint First Nations Fire Protection Strategy (Government of Canada, 2016) outlines four pillars of mutual collaboration between Indigenous and Northern Affairs Canada (INAC) and the Aboriginal Firefighters Association of Canada (AFAC). The intent of this strategy (first established for 2010-2015) is to promote fire protection on reserve. The four pillars of the revised plan (released 2016) focus on: (a) partnership for First Nations fire service, (b) fire prevention education, (c) community standards, and (d) fire service operational standards. The strategy aims to promote fire prevention initiatives that will support First Nations communities reducing the risk of fire-related casualties and loss of infrastructure on reserve. This is particularly crucial in First Nations communities on reserve due to the compounding implications of remoteness, decreased population, and/or limited capacity to sustain a Mutual Type Service Agreement

(MTSA) and/or fire service (Government of Canada, 2016). According to the Joint First Nations Fire Protection Strategy, "'Underserviced' sites are identified as those populated reserve sites without fire prevention programs and limited fire protection services or assets. With this in mind, efforts for fire prevention awareness will first focus on households, followed by the community, and then local fire officials such as firefighters. This will not only increase fire prevention awareness in these communities, but will also improve their capacity for fire protection."

EVIDENCE UNDERPINNING FIRE RISK

This paper is inspired by *A Tale of Two Cities: Master Planning, an Alternative to the Common Practice of Incremental Decision Making* (Institute for Local Self Government, 1977), which uses the premise of two cities (Sampleton and Exville) to compare the long-term implications of divergent high-level decisions about the delivery of public safety services. One city, Sampleton, commits to a long-range, proactive planning approach to fire protection, whilst the other, *Exville,* stays focused on the immediate budget cycle. The moral of the story is that long-range fire prevention vision can save money, maximise efficiency, and enhance safety and service delivery.

Although hypothetical, the message from *A Tale of Two Cities* in this context is well supported by a range of international studies and reviews. From a fire prevention perspective, there is unequivocal Canadian evidence to demonstrate the positive influence working smoke alarms and residential sprinkler systems have on reducing fire-related casualties (see the body of work published on the University of the Fraser Valley *Centre for Public Safety and Criminal Justice Research* fire-focused page: https://cjr.ufv.ca/research/fire/). The largest Canadian retrospective analysis of the performance of fire protection systems in residential buildings was published by Garis, Singh, and Plecas (2019), involving the National Fire Information Database (NFID) assembled by Statistics Canada on behalf of the Canadian Association of Fire Chiefs and the Canadian Association of Fire Commissioners and Fire Marshalls. This analysis examined almost 130,000 fire incident reports filed over an 11 year period between 2005 and 2015. The data was provided by fire services from British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, and New Brunswick. These fire events had resulted in over 1,400 fire-related deaths and almost 9,000 fire-related injuries. Almost two-thirds of these residential fires had no functioning life safety system (smoke alarm or sprinkler system), resulting in almost 80% of the fatalities.

The benefits of present, functioning life safety systems was demonstrated beyond doubt by the Garis et al. (2019) research. The odds of a death in a residential building without sprinklers or a working smoke alarm (12.6 deaths per 1,000 fires) were 4.3 times greater than for fires in buildings with both life safety systems in-place (2.9 deaths per 1,000 fires). Furthermore, there were clear benefits for fire suppression requirements in buildings with effective prevention: fires in buildings with both sprinklers and working smoke alarms needed less frequent fire department intervention to control fires, with fires generally smaller (contained to the room of origin 94% of the time). Given the comprehensive local focus of the data that underpin this analysis, the findings from Garis et al. (2019, Table 1) form the basis of the casualty rate assumptions included in this decision making support tool.

As in *A Tale of Two Cities* (Institute for Local Self Government, 1977), there financial commitment required to coordinate the implementation and maintenance of these types of fire prevention systems. As a result, the decision support tool accompanied by this paper also makes assumptions to provide some costing estimates to determine the possible price of moving to a long-range fire prevention vision. Unlike the casualty parameters (which are based on the Garis et al., 2019 research), the cost estimates have been established through consultation with industry professionals. These cost parameters can be manipulated in the model by the user. The decision support tool makes cost assumptions about:

- **Smoke alarm coverage** – with two costing estimates depending on whether decision-makers choose to follow the requirements of the National Building Code of Canada or past practice regarding the number and location of alarms within each home. It should be noted that, within the tool, adding more alarms only increases the cost without affecting the casualty estimates. This is because the Garis et al. (2019) retrospective analysis was conducted based on knowing whether a house had at least one working smoke alarm.
- **Sprinklers** – with different costs associated with retrofitting existing building stock vs. including them in the design and construction of new homes, and varying costs depending on the type of water supply and whether existing water supplies are pressurised.
- **Fire suppression choices** – influenced by MTSAs, existing fire suppression infrastructure, and intended size of future infrastructure. It should also be noted that, given the likely response time of any volunteer fire suppression response, it is highly unlikely that these resources will have an impact on fire-related casualties. Consequently, this variable only influences cost in the model and does not alter the casualty estimates.

A final important factor that is absent from the tool in both costs and benefits relates to the demonstrated positive impact fire prevention information/education (targeting high-risk behaviour related to cooking, smoking, heating, etc.) can have on driving down casualties (see Clare et al., 2012, for a discussion of a highly successful firefighter-delivered home safety campaign in Surrey, British Columbia). This type of public awareness is consistent with one of the pillars of mutual collaboration specified by the Joint First Nations Fire Protection Strategy (Government of Canada, 2016). Although the costings are not incorporated into the model, it is encouraged that this approach should be considered in parallel with community-wide fire prevention and suppression decisions.

Finally, it is important to emphasize the need for an ongoing commitment to these strategies. Much like a vaccination process, fire safety systems need ongoing maintenance to ensure they will be effective in the event they are required. There are many examples of brief smoke alarm installation drives that are effective for the duration of the program, with gradual compounding decline in working smoke alarm coverage in the years following the program termination. For this reason, the costings involved in the decision-support tool include assumptions about annual maintenance and replacement costs for prevention and suppression equipment.

DECISION SUPPORT TOOL

This decision support tool is intended to aid in policy and program decision making relating to fire prevention in Canadian First Nations communities (a stepping stone to becoming more Sampleton than Exville). The tool provides a user-friendly interface to connect the academic research into fire outcomes (discussed above) with cost estimates relating to fire suppression and fire prevention. The tool is intended to enable users to create ‘what if’ scenarios that link cost-benefits to relative risk to life from fire threats and the characteristics of the community (e.g., population size, number of homes, number of dwelling floors, total size of houses, etc.). The intent is that users of this tool will be able to estimate the cost-benefit of hypothetical changes to their current coverage of smoke alarms, residential fire sprinklers, and fire suppression resourcing. It is then up to the user to determine what decisions they wish to make moving forward (see the disclaimer, below).

WORKED EXAMPLES

To provide context to users of the risk model, this supporting document includes two worked examples that demonstrate how the model inputs influence the risk and cost predictions. When working through these examples and entering the parameters for a specific community, users must remember that the model predicts the likely fire-related casualties based only on in-built protection systems (sprinklers and smoke alarms) – the fire department size/presence does not influence these estimates, nor does the number of smoke alarms installed (as explained, above). Both fire department options and fire protection systems influence the purchase and maintenance costs associated with the parameters you choose. This model is intended to act as a decision-making support tool, the implementation of which is done at the users discretion.

There is flexibility within the tool to adjust the costings estimates, all included in the "Background" tab located within the red cells. The default costings are all based on industry consultation undertaken by the decision tool development team, but they are considered to be indicative only. The assumed costs can be seen in Table 5 of the "Background" tab (Excel file), where any necessary adjustments can be made, with changes flowing through to the risk tool costing outputs.

Within the two worked examples, the relevant section of the "Inputs" tab are represented by their corresponding number in **red font.**

EXAMPLE COMMUNITY A

BACKGROUND

Community A **(1)** has 200 people **(3)** living in 150 homes **(7)** across a geographical area of 100 square kilometres **(2)**. These homes are typically 2 story **(12)** including the basement and usually contain 2 bedrooms **(13)**. These single family homes are approximately 1,200 square feet **(11)** in size including the basement area.

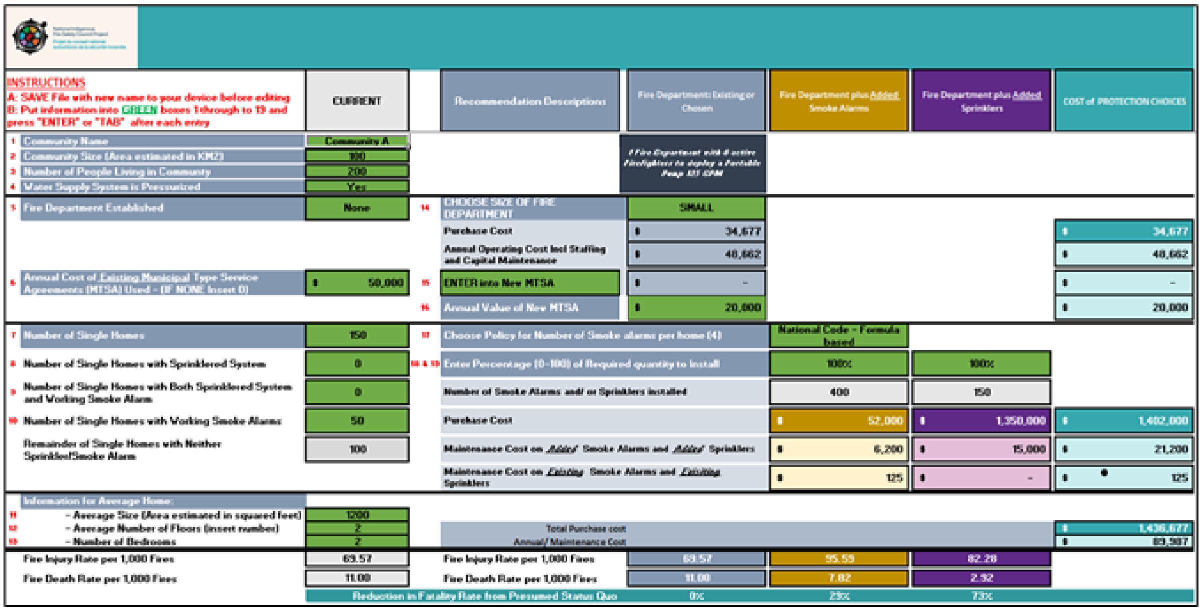
DESCRIPTION OF CURRENT PROTECTION LEVELS

- Community level
  - The community's water supply system is a pressurized water system **(4)**.
  - There is no fire department **(5)** present but Community A has a MTSA to use the fire protection services from a neighbouring community at the annual cost of $50,000 **(6)**.
- Household level
  Based on community records and/or administrator's experience with community estimates of how many of the 150 homes have the varying levels of protection show the following:
  - Number of single homes with sprinkler systems **(8)** = 0.
  - Number of single homes with **both** sprinkler systems **and** working smoke alarms **(9)** = 0.
  - Number of single homes with working smoke alarms **(10)** = 50.
  - The decision tool then automatically calculates the number of remaining homes that must have no protection = 100.

Based on this information about current protection levels, the current death and injury rates are derived using the parameters discussed, above.

ESTIMATING THE COST AND CASUALTY IMPLICATIONS OF DECISIONS ABOUT PROTECTION UPGRADES

- Community level
  - The decision is made to introduce a small fire department **(15)**. The purchase cost is calculated for all the one time additional capital costs set up a department equipped for that size. The annual costs to run, staff, and maintain the selected small-sized fire department is calculated automatically. Any required edits to underlying costings for fire department resources can be made at **("Background" tab Table 5).**
  - The decision is made to downsize the existing MTSA and enter into a new agreement **(15)** for reduced service levels at a cost of $20,000 per year **(16)**.
- Household level
  - The decision is made to use the National Building Code as a basis for how many smoke alarms to install in each home **(17)**.
  - The decision is made to install 100% of the required smoke alarms for homes currently missing smoke alarm protection **(18)**. The installation and maintenance costs are calculated and the fire related casualty rates are updated to reflect the additional alarm protection.
  - The decision is made to install 100% of the required sprinkler systems for homes currently missing sprinkler protection **(19)**. The installation and maintenance costs are calculated and the fire related casualty rates are updated to reflect the additional sprinkler protection.



INSTRUCTIONS
A: SAVE File with new name to your device before editing
B: Put information into GREEN boxes 1 through to 13 and press "ENTER" or "TAB" after each entry

#	Item	CURRENT	#	Recommendation Descriptions	Fire Department: Existing or Chosen	Fire Department plus Added Smoke Alarms	Fire Department plus Added Sprinklers	COST of PROTECTION CHOICES
1	Community Name	Community A			1 Fire Department with 8 active Firefighters to deploy a Portable Pump 125 GPM			
2	Community Size (Area estimated in KM2)	100						
3	Number of People Living in Community	200						
4	Water Supply System is Pressurized	Yes						
5	Fire Department Established	None	14	CHOOSE SIZE OF FIRE DEPARTMENT	SMALL			
				Purchase Cost	$ 34,677			$ 34,677
				Annual Operating Cost Incl Staffing and Capital Maintenance	$ 48,662			$ 48,662
6	Annual Cost of Existing Municipal Type Service Agreements (MTSA) Used - (IF NONE Insert 0)	$ 50,000	15	ENTER into New MTSA	$ -			$ -
			16	Annual Value of New MTSA	$ 20,000			$ 20,000
7	Number of Single Homes	150	17	Choose Policy for Number of Smoke alarms per home (4)		National Code - Formula based		
8	Number of Single Homes with Sprinklered System	0	18 & 19	Enter Percentage (0-100) of Required quantity to Install		100%	100%	
9	Number of Single Homes with Both Sprinklered System and Working Smoke Alarm	0		Number of Smoke Alarms and/ or Sprinklers installed		400	150	
10	Number of Single Homes with Working Smoke Alarms	50		Purchase Cost		$ 52,000	$ 1,350,000	$ 1,402,000
	Remainder of Single Homes with Neither Sprinkler/Smoke Alarm	100		Maintenance Cost on Added Smoke Alarms and Added Sprinklers		$ 6,200	$ 15,000	$ 21,200
				Maintenance Cost on Existing Smoke Alarms and Existing Sprinklers		$ 125	$ -	$ 125
	Information for Average Home:							
11	- Average Size (Area estimated in squared feet)	1200						
12	- Average Number of Floors (insert number)	2		Total Purchase cost				$ 1,436,677
13	- Number of Bedrooms	2		Annual/ Maintenance Cost				$ 89,987
	Fire Injury Rate per 1,000 Fires	69.57		Fire Injury Rate per 1,000 Fires	69.57	95.59	82.28	
	Fire Death Rate per 1,000 Fires	11.00		Fire Death Rate per 1,000 Fires	11.00	7.82	2.92	
				Reduction in Fatality Rate from Presumed Status Quo	0%	29%	73%	

INTERPRETING THE ANTICIPATED COST-BENEFIT OF COMMUNITY A'S CHOICES

Based on the pre-intervention fire protection system coverage, Community A was estimated to be likely to experience an injury of rate of 69.6 per 1,000 fires and a death rate of 11.0 per 1,000 fires. The cost of the existing MTSA was $50,000.

The influence of the parameters entered into the model produce three, cumulative estimates that influence cost and predicted casualties:

- Fire suppression decisions: Community A's upgrade has a purchase ($34,677) and annual operating ($48,662) cost, plus a downgraded cost of the MTSA ($20,000). This decision does not impact on the predicted casualties, based on the parameters in the decision-making tool (as discussed, above).
- Additional smoke alarms: The decision to follow the National Building Code of Canada and to install alarms in every property where they are required (4 alarms per home for the 100 homes without alarms) results in a purchase cost of $52,000, with an additional $6,325 in annual maintenance costs. This reduces the estimated rate of fire-related deaths by 29%, but increases estimated rate of fire-related injury by 37% (a pattern observed in previous research, where alarms act to alert residents to attempt to suppress fires themselves, thus increasing injury).
- Retro-fitting residential sprinkler systems: The choice to retro-fit all homes that needed residential sprinklers (all 150) results in a purchase cost of $1.35 million plus ongoing annual maintenance costs of $15,000. This reduces the estimated rate of fire related deaths by 73%, whilst increasing the estimated rate of fire-related injuries by 18%.
- The total purchase cost of these upgrades would be $1.4 million, with an ongoing annual commitment of almost $90,000.

EXAMPLE COMMUNITY B

BACKGROUND

Community B **(1)** has 200 people **(3)** living in 150 homes **(7)** across a geographical area of 100 square kilometres **(2)**. These homes are typically 2 story **(12)** including the basement and usually contain 2 bedrooms **(13)**. These single family homes are approximately 1,200 square feet **(11)** in size including the basement area.

DESCRIPTION OF CURRENT PROTECTION LEVELS

- Community level
  - The community's water supply system is a pressurized water system **(4)**.
  - There is a small fire department **(5)** present and Community B also has a MTSA to use the fire protection services from a neighbouring community at the annual cost of $20,000 **(6)**.

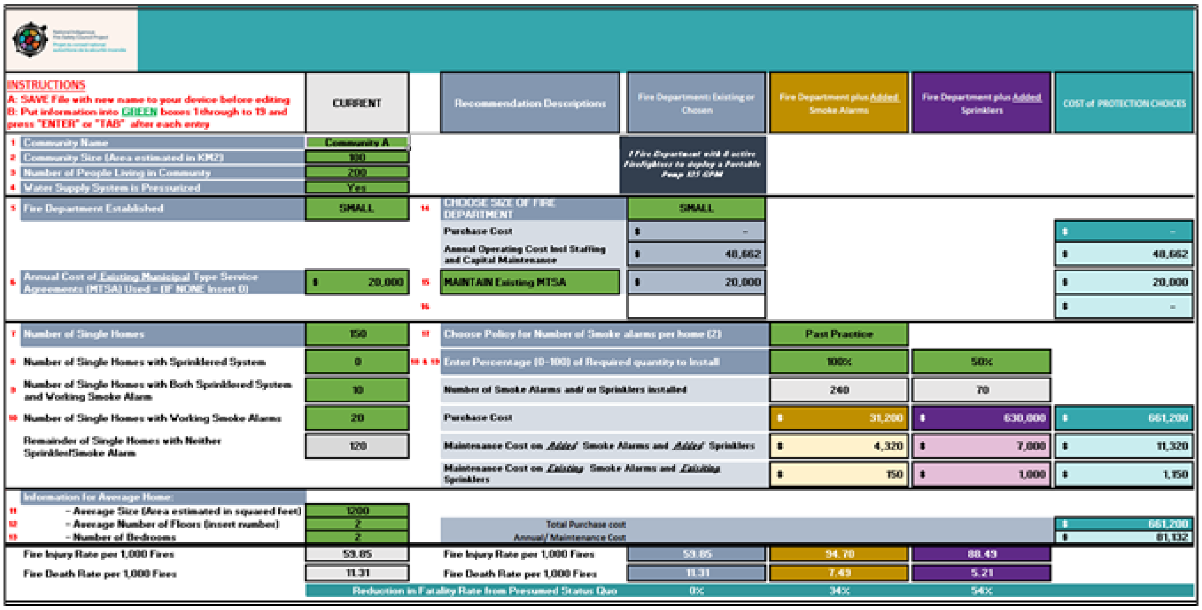
- Household level

  Based on community records and/or administrator's experience with community estimates of how many of the 150 homes have the varying levels of protection show the following:
  - Number of single homes with sprinkler systems **(8)** = 0.
  - Number of single homes with both sprinkler systems and working smoke alarms **(9)** = 10.
  - Number of single homes with working smoke alarms **(10)** = 20.
  - The decision tool then automatically calculates the number of remaining homes that must have no protection = 120.

Based on this information about current protection levels, the current death and injury rates are derived using the parameters discussed, above.

ESTIMATING THE COST AND CASUALTY IMPLICATIONS OF DECISIONS ABOUT PROTECTION UPGRADES

- Community level
  - The decision is made to keep the existing small fire department **(15)**. The purchase cost is $0 because it is assumed there are no additional one-time capital costs to set-up a department equipped for that size. The annual costs to run, staff, and maintain the selected small-sized fire department is calculated automatically. Any required edits to underlying costings for fire department resources can be made at ("Background" tab Table 5).
  - The decision is made to maintain the existing MTSA **(15)** at a cost of $20,000 per year.
- Household level
  - The decision is made to follow past practice as a basis for how many smoke alarms to install in each home **(17)**.
  - The decision is made to install 100% of the required smoke alarms for homes currently missing smoke alarm protection **(18)**. The installation and maintenance costs are calculated and the fire related casualty rates are updated to reflect the additional alarm protection.
  - The decision is made to install 50% of the required sprinkler systems for homes currently missing sprinkler protection **(19)**. The installation and maintenance costs are calculated and the fire related casualty rates are updated to reflect the additional sprinkler protection.



No.	INSTRUCTIONS A: SAVE File with new name to your device before editing B: Put information into GREEN boxes 1 through to 19 and press "ENTER" or "TAB" after each entry	CURRENT	No.	Recommendation Descriptions	Fire Department: Existing or Chosen	Fire Department plus Added Smoke Alarms	Fire Department plus Added Sprinklers	COST of PROTECTION CHOICES
1	Community Name	Community A			1 Fire Department with 8 active Firefighters to deploy a Portable Pump 125 GPM			
2	Community Size (Area estimated in KM2)	100						
3	Number of People Living in Community	200						
4	Water Supply System is Pressurized	Yes						
5	Fire Department Established	SMALL	14	CHOOSE SIZE OF FIRE DEPARTMENT	SMALL			
				Purchase Cost	$ –			$ –
				Annual Operating Cost Incl Staffing and Capital Maintenance	$ 48,662			$ 48,662
6	Annual Cost of Existing Municipal Type Service Agreements (MTSA) Used – (IF NONE Insert 0)	$ 20,000	15	MAINTAIN Existing MTSA	$ 20,000			$ 20,000
			16					$ –
7	Number of Single Homes	150	17	Choose Policy for Number of Smoke alarms per home (2)		Past Practice		
8	Number of Single Homes with Sprinklered System	0	18 & 19	Enter Percentage (0-100) of Required quantity to install		100%	50%	
9	Number of Single Homes with Both Sprinklered System and Working Smoke Alarm	10		Number of Smoke Alarms and/ or Sprinklers installed		240	70	
10	Number of Single Homes with Working Smoke Alarms	20		Purchase Cost		$ 31,200	$ 630,000	$ 661,200
	Remainder of Single Homes with Neither Sprinkler/Smoke Alarm	120		Maintenance Cost on *Added* Smoke Alarms and *Added* Sprinklers		$ 4,320	$ 7,000	$ 11,320
				Maintenance Cost on *Existing* Smoke Alarms and *Existing* Sprinklers		$ 150	$ 1,000	$ 1,150
	Information for Average Home:							
11	– Average Size (Area estimated in squared feet)	1200						
12	– Average Number of Floors (insert number)	2		Total Purchase cost				$ 661,200
13	– Number of Bedrooms	2		Annual/ Maintenance Cost				$ 81,132
	Fire Injury Rate per 1,000 Fires	59.85		Fire Injury Rate per 1,000 Fires	59.85	94.70	88.49	
	Fire Death Rate per 1,000 Fires	11.31		Fire Death Rate per 1,000 Fires	11.31	7.49	5.21	
		Reduction in Fatality Rate from Presumed Status Quo			0%	34%	54%	

INTERPRETING THE ANTICIPATED COST-BENEFIT OF COMMUNITY B'S CHOICES

Based on the pre-intervention fire protection system coverage, Community B was estimated to be likely to experience an injury of rate of 59.8 per 1,000 fires and a death rate of 11.3 per 1,000 fires. The cost of the existing MTSA was $20,000.

The influence of the parameters entered into the model produce three, cumulative estimates that influence cost and predicted casualties:

> Fire suppression decisions: Community B's choice to maintain their existing fire suppression resourcing meant no purchase costs and a continued annual operating cost of $48,662, plus the ongoing cost of the MTSA ($20,000). As before, this decision does not impact on the predicted casualties, based on the parameters in the decision-making tool (as discussed, above).

> Additional smoke alarms: The decision to follow the 'Past Practice' approach to the number of alarms per house and to install alarms in every property where they are required (2 alarms per home for the 120 homes without alarms) results in a purchase cost of $31,200, with an additional $4,470 in annual maintenance costs. This reduces the estimated rate of fire-related deaths by 34%, but increases estimated rate of fire-related injury by 58% (a pattern observed in previous research, where alarms act to alert residents to attempt to suppress fires themselves, thus increasing injury).

> Retro-fitting residential sprinkler systems: The choice to retro-fit 50% of homes that needed residential sprinklers (70 homes) results in a purchase cost of $630,000 plus ongoing annual maintenance costs of $8,000. This reduces the estimated rate of fire related deaths by 54%, whilst increasing the estimated rate of fire-related injuries by 48%.

> The total purchase cost of these upgrades would be $661,200, with an ongoing annual commitment of just over $81,000.

REFERENCES AND SUPPORTING DOCUMENTATION

> Canada Mortgage and Housing Corporation (2007). Fire Prevention in Aboriginal Communities. Last accessed on 23 February 2021. Available from: http://publications.gc.ca/site/eng/331289/publication.html

> Clare, J., Garis, L., Plecas, D., & Jennings, C. (2012). Reduced frequency and severity of residential fires following delivery of fire prevention education by on-duty fire fighters: cluster randomized controlled study. Journal of Safety Research, 43(2), pp.123-128. Available from: https://www.sciencedirect.com/science/article/pii/S0022437512000230

> Garis, L., Singh, A., & Plecas, D. (2019). Fire protection system(s) performance in the residential building environment: examining the relationship between civilian and firefighter injuries – a retrospective evaluation of residential fires, 2005-2015. Report available at the University of the Fraser Valley Centre for Public Safety and Criminal Justice Research: https://cjr.ufv.ca/fire-protection-systems-performance-in-the-residential-building-environment-examining-the-relationship-between-civilian-and-firefighter-injuries-a-retrospective-evaluation-of-residential-and-resid/

> Government of Canada (2016). Joint First Nations Fire Protection Strategy (2016-2021). Last accessed on 23 February 2021. Available from: https://www.sac-isc.gc.ca/eng/1462282755363/1535122983939

> Huesken, S., Xiao, R.Y., Jennings, C., & Dow, M. (2020). Moving from risk assessment to risk reduction: an analysis of fire-related risk factors in First Nation/Indian Band or Tribal Council areas across Canada. Report prepared for the Aboriginal Firefighters Association of Canada. Available from: https://indigenousfiresafety.ca/moving-from-risk-assessment-to-risk-reduction/

> Institute for Local Self Government (1977). A Tale of Two Cities: Master Planning, an Alternative to the Common Practice of Incremental Decision Making. Available for purchase at: https://books.google.com.au/books/about/A_Tale_of_Two_Cities.html?id=OaNpwAEACAAJ&redir_esc=y

LIMITATIONS

This supporting document is designed to accompany the Excel-based model, available for download from XXXX. The materials available on or through this website are distributed by the National Indigenous Fire Safety Council (NIFSC) as an information source and decision support tool only. Despite our best efforts, the NIFSC makes no warranties about the materials available on or though this website publication and takes no responsibility or liability for their use.

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