MECHANICAL INSULATORS
LMCT
Labor Management Cooperative Trust
ENERGY CONSERVATION SPECIALISTS

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The following pages will outline a case study, which shows the benefits in energy and cost savings of properly installed mechanical insulation.

Insulation is a proven means for conserving energy, reducing greenhouse gas emissions, increasing process productivity, providing a safer and more productive work environment, controlling condensation (which can lead to mold growth), supporting sustainable design technology and a host of other benefits.

Mechanical insulation does all of this, while providing a return on investment (ROI) rate, which is seldom rivaled. Despite the proven ROI, insulation is often overlooked and its benefits undervalued. Insulation is truly the lost or forgotten technology. Can you think of a more important time than now to think about how insulation can help you?

An insulation system is a technology, which needs to be engineered and maintained throughout the entire process. Several studies have estimated roughly 10 to 30 percent of all installed insulation is now missing or damaged.

The practice of not replacing or maintaining an insulation system in a timely and correct manner reduces the full benefits of insulation, and in return, decreases the ROI. In many cases, significant other issues - such as excessive energy loss, corrosion under insulation (CUI), mold development, increased cost of operations and reduced process productivity or efficiency - develop.

You can learn more on www.MechanicalInsulatorsLMCT.com, where additional case studies can be viewed.

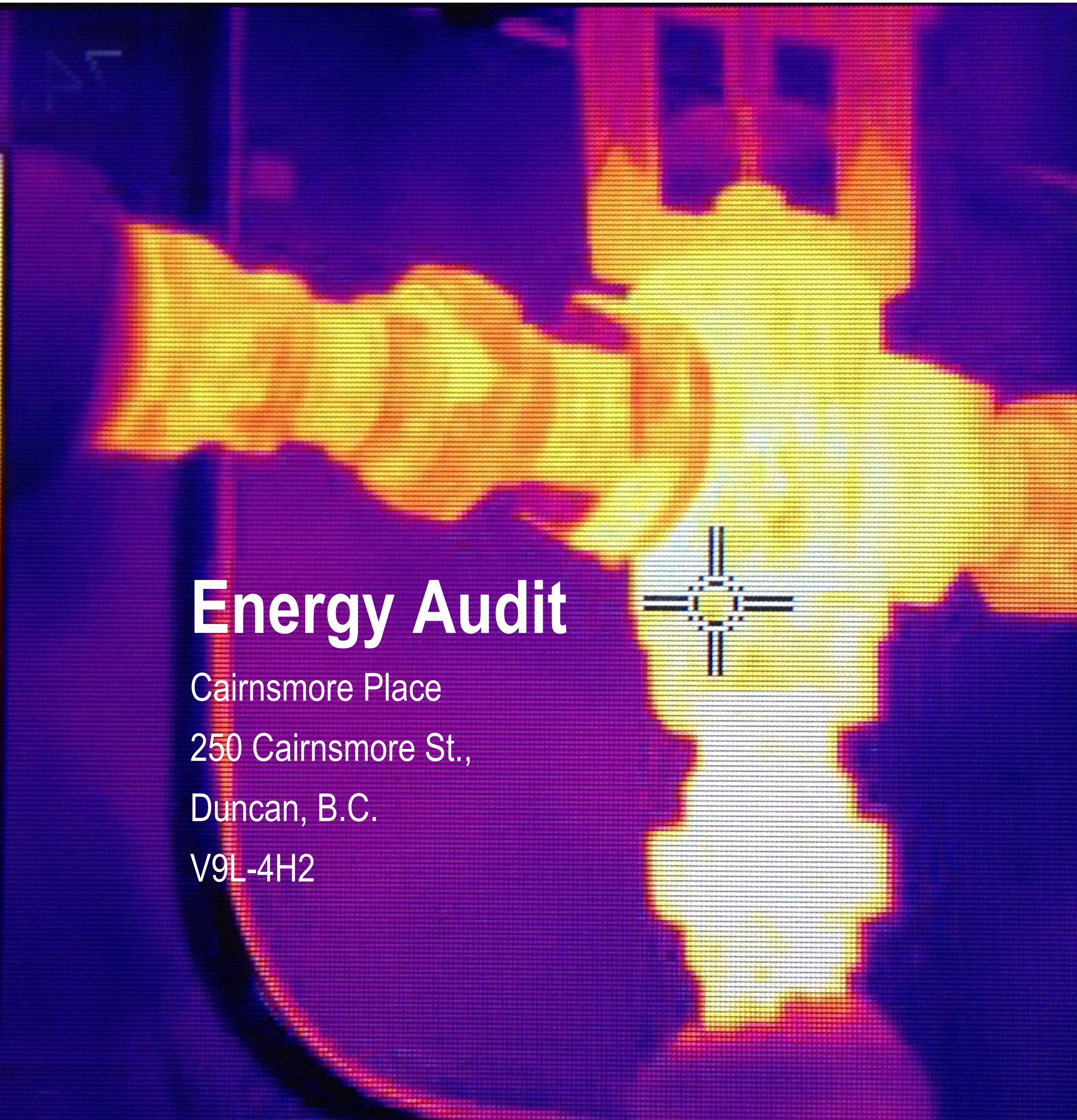
Please do not hesitate to contact me should you have any additional questions.
Thank you,

Peter Ielimi

Executive Director
Mechanical Insulators Labor Management Cooperative Trust

SALAMANDER INSPECTIONS LTD

Mechanical Insulation Energy Audits



Energy Audit

Cairnsmore Place

250 Cairnsmore St.,

Duncan, B.C.

V9L-4H2

Executive Summary

Cairnsmore Place is located at 250 Cairnsmore Place, Duncan, British Columbia. The care home is a multi level healthcare facility operated by Island Health Authority. For this report our inspection was for this buildings mechanical room and fan rooms only.

Salamander Inspections performed an energy audit of the insulation systems within the main Boiler Room and Penthouse Fan Room. The purpose of the audit was to determine the current state of mechanical insulation applied to the systems.

Our findings indicate that there are opportunities to improve the mechanical insulation systems in a cost effective manner. The benefits are itemized below. Any deviation from following the Best Practices Guideline[1] developed by the North American Insulation Institute will reduce the potential savings and benefits. For example, we know that the elimination of canvas jacket can shorten the lifespan of fiberglass with an ASJ finish because of the lack of a protective cladding system. We also recommend using removable insulating pads where necessary or required for maintenance to ensure that the insulation systems remain intact for as long as possible.

Undertaking the projects we have identified in our review will yield:

1) Annual reduction of heat loss **- 128 Gj** and a **ROI of 1.67 years**
2) Annual cost savings derived through properly insulated piping - **$1,888.00**
3) Potential savings on maintenance costs for equipment
4) Elimination of personal protection hazards

[1] Refer to http://insulationinstitute.org/tools-resources/resource-library/codes-standards/ for more information in mechanical insulation systems.

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Introduction

Mr. Kevin Ramlu, Energy Specialist for Island Health retained Salamander Inspections Ltd. to complete a review of mechanical insulation systems applied to the heating systems at Cairnsmore Place located in Duncan, British Columbia. The goal of the assessment is to find energy savings for the care home.

About Salamander Inspections and the FLIR Thermographic Camera

Salamander Inspections Ltd. is a third party inspection service providing energy audits for mechanical systems in the Commercial/Institutional sector. We are utilizing a state of the art FLIR thermographic camera to provide us with accurate measurements and photographs of heat loss and gain on mechanical systems within the scope of work determined by our clients.

This heating plate exchanger, as photographed by the FLIR camera uses sensors built within the camera to show the heat radiating from the valve. The brighter the color the hotter the temperature of the object. The camera must be set up to filter out the ambient heat from surrounding objects to ensure that the temperatures are accurate. The camera then takes a thermal image as well as a digital picture for reference.

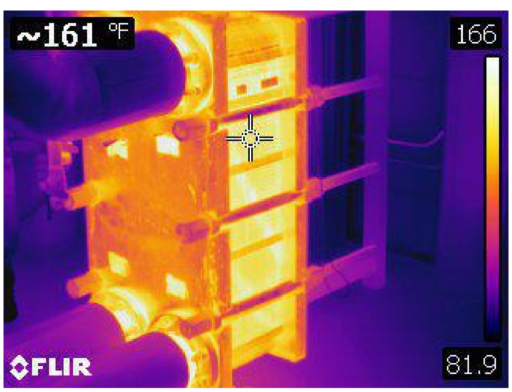

Figure 1 This is an infrared photo of the heat exchanger showing the areas with where large temperature differences create high rates of heat transfer.

Figure 2 This photo shows the same plate heat exchanger.

Methodology

The audit was performed by systematically inspecting the condition of all mechanical systems within the scope of work. The type of system, condition, temperature and footage was recorded and used to determine outcomes that will be beneficial to the operation of the building. The areas targeted within the scope of work have been checked using a FLIR digital thermal imaging camera which shows clearly problem areas that may not be seen with the naked eye. High rates of heat transfer are indicated in areas where there are large color differences between the background elements within the area.

After identifying the problem areas with an infrared camera, we then completed simulations of different mechanical insulation systems. In this way, we were able to develop a cost versus benefit model for different insulation systems

Study Findings

Boiler Room

In general, workmanship on the insulation systems is good but there were some deficiencies if we compare the systems to the standards established in Best Practices Guideline[2] developed the North American Insulation Institute. For instance, valves, pumps, flanges and or fittings are missing insulation either by not being done at the time of construction or by ongoing maintenance of piping and equipment. However, we note that some specifications expressly omit this requirement thereby increasing operating costs for the owner. We are continuing our efforts to reach out to the engineering community to get elements such as these changed in specifications.

We have assessed the boiler room and found that the insulation applied to the older existing mechanical systems is in generally good condition. We noted that the insulation is 1 inch thick (25mm). Current best practices and ASHRAE 90.1 (2010) requires that the insulation applied to heating systems be 1 ½ inch thick (40mm).

There are instances where pumps, valves and piping have no insulation applied and therefore, there is an opportunity to reduce operation costs. During the course of this inspection we counted (9) valves, (12) flanges, (12) pumps and (7) valve bonnets that should be insulated.

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[2] Refer to http://insulationinstitute.org/tools-resources/resource-library/codes-standards/ for more information in mechanical insulation systems.

Sample photos are provided below showing various components of the mechanical systems where upgrading the mechanical insulation will reduce operating costs by reducing energy consumption and extending the service life of equipment and also improve personnel safety (Figures 3 to 28).

Figure 3 This thermographic image is of bare heating supply lines and valves at 87º C or 188º F.

Figure 4 This is a conventional photo of the same piping and valves from the boilers.

Figure 5 This Thermographic image of a re-circ pump adjacent to boilers.

Figure 6 This conventional photo shows the same re-circ pump at the boilers.

Figure 7 This is a thermographic image of copper pipe at the hot water tanks at 44.1º C or 111º F.

Figure 8 This is a conventional photo of the two heating pump and copper pipe at the hot water tank.

Figure 9 This is a thermographic image of copper pipe heating supply at 35.2º C or 95 F.

Figure 10 This is the conventional image of the same copper line from the hot water tank.

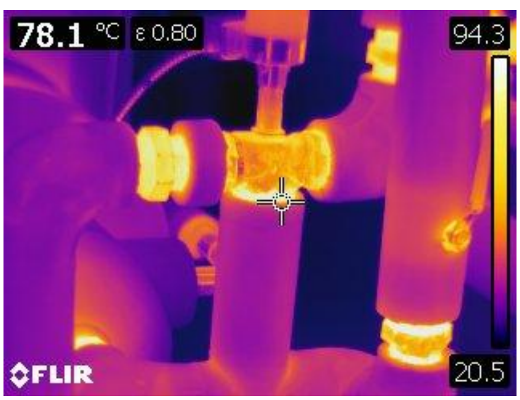

Figure 11 Thermographic image of bare motorized tee and associated fittings at the hot water tanks at 78.1º C or 172 F.

Figure12 This is a conventional image of the same bare tee's and fittings.

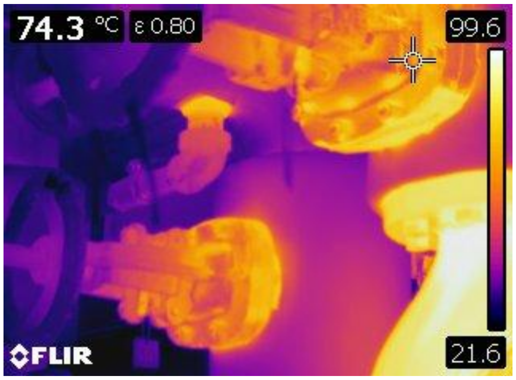

Figure 13 Thermographic image of bare valve bonnets on the heating supply at 74.3º C or 165 F.

Figure 14 Conventional image of the same bare valve bonnets.

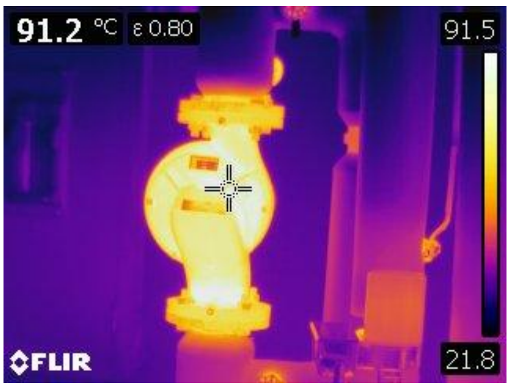

Figure 15 Thermographic image of a motorized heating pump at 91.2º C or 196 F.

Figure 16 Conventional image of the heating pump.

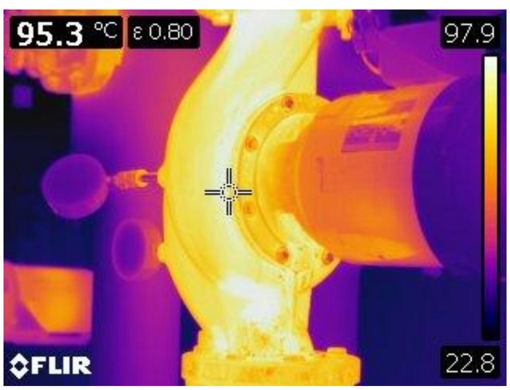

Figure 17 Thermographic image of motorized pump at 95.3º C or 203º F.

Figure 18 Conventional picture of the same motorized pump.

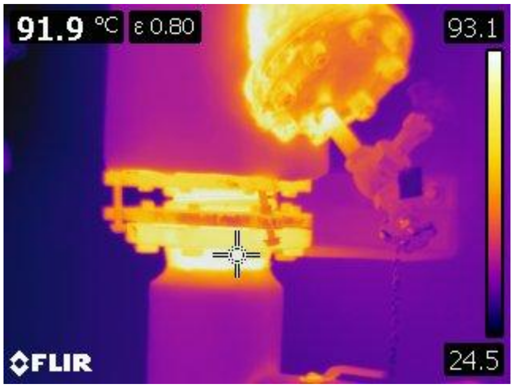

Figure 19 Thermographic image of a bare flange and strainer 91.9º C or 197º F.

Figure 20 Conventional image of the same flange and strainer.

Figure 21 Thermographic image of a motorized heating pump at 56.7º C or 134º F.

Figure 22 conventional image of the same motorized pump.

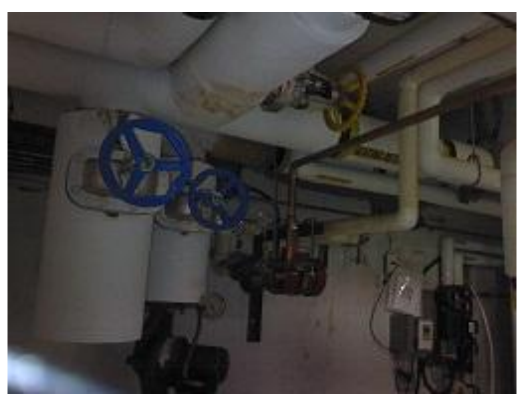

Figure 23 Thermographic image of a copper line from heating pump at 37.1º C or 98º F.

Figure 24 Conventional image of the same copper line from pump.

Figure 25 Thermographic image of bare copper piping at 44.2º C or 111º F.
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Figure 26 Conventional image of the same copper piping and valve.

Figure 27 Thermographic image of pressure relief piping from the boiler at 91.3º C or 196º F.

Figure 28 Conventional image of the same piping from boiler.

Penthouse Fan Room

The inspection of the penthouse fan room mechanical area has revealed that the insulation was generally applied correctly. The issue remains however that there is insulation is missing on some of the piping and pumps. There is evidence that maintenance has caused insulation to be removed and the material has not been replaced. Failure to complete the insulation system has left opportunities to improve or upgrade the insulation and receive benefits to the cost of operation. At time of inspection heat recovery was being added on roof and is not included. (figures 29– 34)

Figure 29 Thermographic image of bare motorized Tee at 93.2º C or 199º F.

Figure 30 Thermographic image of the same bare motorized Tee.

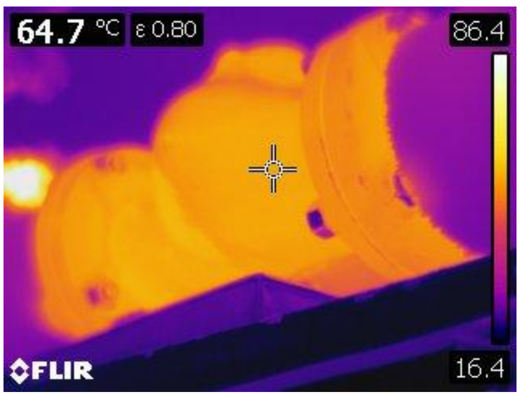


Figure 31 Thermographic image of bare motorized heating pump at 93.2º C or 199º F .

Figure 32 Conventional image of the same motorized heating pump.

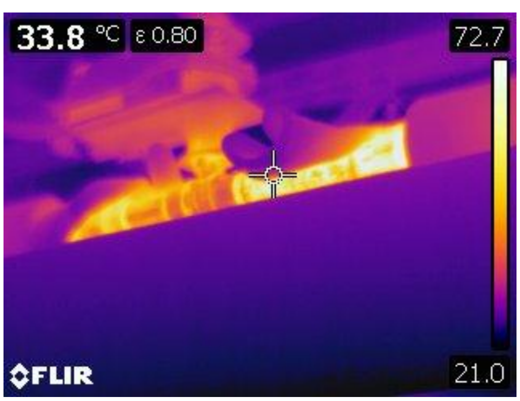


Figure 33 Thermographic image of motorized valve and pipe at 33.8º C or 92º F .

Figure 34 Conventional image of the same valve and pipe.

Personnel Protection

It is also important to recognize the hazards that hot exposed surfaces present to personnel. The boiler rooms and fan rooms generally are tightly packed with equipment and piping systems operating at temperatures of nearly 62ºC. (People experience burns at temperatures above 65C). Un-insulated or exposed surfaces at these high temperatures are to be considered a serious risk for staff and personnel. Properly insulated systems and equipment eliminate the possibility of individuals coming into contact with these hot surfaces and will prevent accidental burns. This is an important life safety and financial consideration.

Energy Calculations

Table 1.0 below summarizes our energy calculation. We completed our calculations using a program developed by the Insulation Institute (see insulationinstitute.org) called 3E Plus. We can make our detailed calculations available upon request.

The summary provides an aggregate heat loss rate for...

Table 1.0 Energy and Financial Savings

Hours of Operation	KWh from Spreadsheet	Gigajoules Saved
8760	35588	128
	Cost of fuel	$ 14.75
	total	**$1,888.00**

Table 2.0 Greenhouse Gas Emission Reduction-from NRCAN spreadsheet

Greenhouse Gas	CO2	NOx
before	18867	2146
after	37.84	4.3
Total removed	6.4 tonnes	0.0 tonnes

Insulation Materials

Table 3.0 provides a list of materials needed to insulate areas noted during our inspection, these are used as input for the 3EPlus spreadsheet for heat loss calculations. The insulation costs are estimates only and should not be used as actual costs.

Table 3.0 Insulation Upgrade Pricing Summary

Pipe Sizes	Square footage or Lineal feet	Cost of Material
Tank Wrap		
5/8		
½		
3/4	45 ft @ $ 17.92	$ 806.40
1	25 ft @ $ 18.08	$ 452.00
1 1/4	6 ft @ $ 18.64	$ 111.84
1 ½		
2	35 ft @ $ 19.35	$ 677.25
2 1/8		
2 ½		
2 5/8		
3		
3 1/8		
4		
5		
6	29 ft @ $ 24.14	$ 709.23
7	2.81 ft @ $ 25.12	$ 70.58
8	12.16 ft @ $ 26.59	$ 323.33
10		
12		
14		
	Total	**$ 3,150.63**

All materials noted in the above table are to be of a wall thickness of 1.5 inches or greater dependent upon temperature rating. The costs for insulation include PVC cladding, elbows and fittings. The cost of labor is also part of the lineal footage costs. Price also includes 5% for PST. We highly recommend that Island Health get three quotes to compare. This price is an estimate only and may not be considered an exact amount.

Recommendations and Conclusions

Our findings indicate that there are opportunities to improve the mechanical insulation systems in a cost effective manner. The benefits are itemized below. Any deviation from following the Best Practices Guideline[3] developed by the North American Insulation Institute will reduce the potential savings and benefits. For example, we know that the elimination of canvas jacket can shorten the lifespan of fiberglass with an ASJ finish because of the lack of a protective cladding system. We also recommend using removable insulating pads where necessary or required for maintenance to ensure that the insulation systems remain intact for as long as possible.

If all areas are addressed, the benefits shall include:

1) Annual reduction of heat loss - **128 GJ**
2) Annual cost savings derived through properly insulated piping - **$1,888.00**
3) Potential savings on maintenance costs for equipment
4) Elimination of personal protection hazards Disclosure
5) We have no relevant financial or non-financial relationships to disclose.

[3] Ibid.

Limitations

We have used information provided to us from various sources but information such as operational heating cycles and cooling cycles are based on conversations with maintenance personnel.

Disclaimer

Results stated in this report are estimated and based upon the data supplied or determined during the audit process. Only the previously agreed to areas have been included in this report. These results are not covered by warranty nor are they guaranteed. The results are intended to portray a reasonable estimate of potential energy savings and emissions reduction with the use of an upgraded and maintained insulation system.

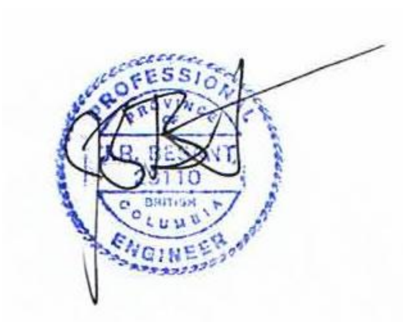
Please contact the undersigned should you have questions about this report.

Best regards,

Report prepared by:
Salamander Inspections

Bob Barter (Project Coordinator)

Reviewed by:
Besant and Associates Engineers Ltd.



Jeff Besant, MBA, P.Eng.