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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.

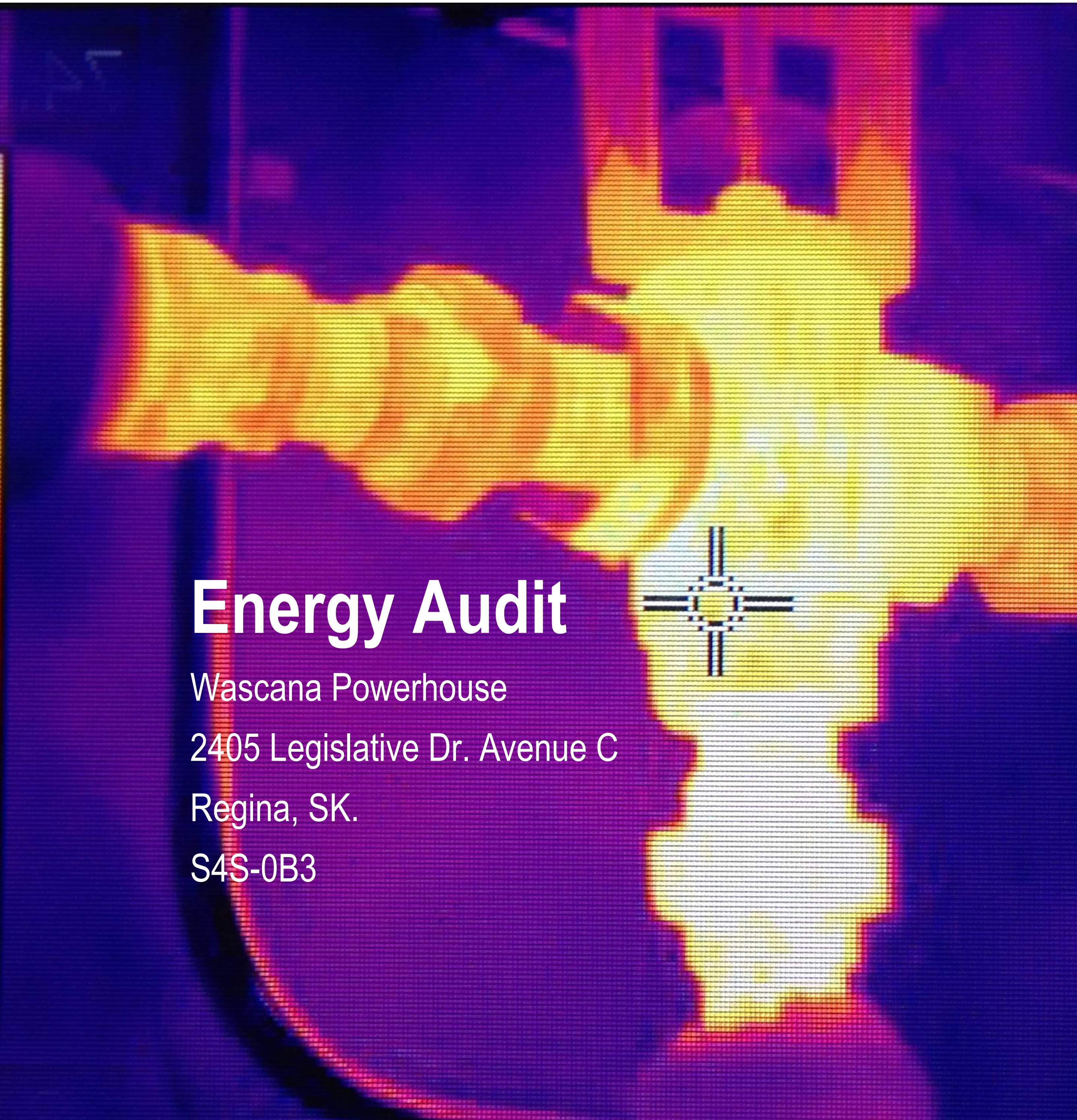
Please do not hesitate to contact me should you have any additional questions.
Thank you,

Peter Ielimi

Executive Director
Mechanical Insulators Labor Management Cooperative Trust

Salamander Inspections Ltd.

Mechanical Insulation Energy Audits



Energy Audit

Wascana Powerhouse

2405 Legislative Dr. Avenue C

Regina, SK.

S4S-0B3

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Executive Summary

The Wascana Powerhouse is located at 2405 Legislative Dr. adjacent to Avenue C on the Saskatchewan Legislative grounds, in Regina, Saskatchewan. This powerhouse is two level, multi-room facility operated by the Government of Saskatchewan. The facility supplies heat through utility tunnels to The Saskatchewan Legislative Building, Walter Scott Building, the T.C Douglas Building, and the Wascana Rehabilitation Facility. For this report, our inspection concerns the Powerhouse, Furnace Room, and the utility tunnels to each building.

Salamander Inspections Ltd. in partnership with Local 119 Heat and Frost Insulator members performed an energy audit of the insulation systems within the main Powerhouse Building, its Furnace Room, and utility tunnels to all connected buildings. 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 TIAC (Thermal Insulation Association of Canada) will reduce the potential savings and benefits. For example, we know that the elimination of jacketing 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.

[1] Refer to www.tiac.ca for more information of mechanical insulation systems guidelines.

SUMMARY RESULTS

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

1) Annual reduction of heat loss - **Powerhouse – 6141Gj**

   Tunnels – 1077 Gj

   Total – 7218 Gj

2) Annual cost savings derived through properly insulated piping -

   Powerhouse – $13,203.15

   Tunnels – $2315.55

   Total – $15,518.70

3) Total Return On Investment **– 1.93 years**

4) Greenhouse Gas Emission Reduction – **CO_2 358 Tonnes NOx 1.9 Tonnes**

5) Potential savings on maintenance costs for equipment

6) Elimination of personal protection hazards

In the process of the inspection asbestos containing materials were observed in many areas. Some of these areas are clearly marked and others are not. We observed a number of areas which were asbestos containing that are damaged, these areas need to be addressed for the protection of all workers. Areas such as the tunnels have debris lying on the floor which may contain asbestos materials. There is no inclusion of costs associated with the abatement or removal of asbestos containing materials in the costs of insulation required to address the items in this report.

Introduction

Following a meeting with the Ministry of Central Services, Local 119 Heat and Frost Insulators were contacted by Jared Kleisinger and Lee Kuruliak about performing reviews of the current mechanical insulation applied to the heating systems in government owned buildings. Representatives of Local 119 in partnership with Salamander Inspections Ltd. conducted the first of these audits at the Wascana Powerhouse at 2405 Legislative Drive, Regina, SK. This powerhouse provides steam to the Legislative building and many other buildings in the area. The goal of the assessment is to find **energy savings and GHG reduction** for the Government of Saskatchewan.

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 heat exchanger. 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.

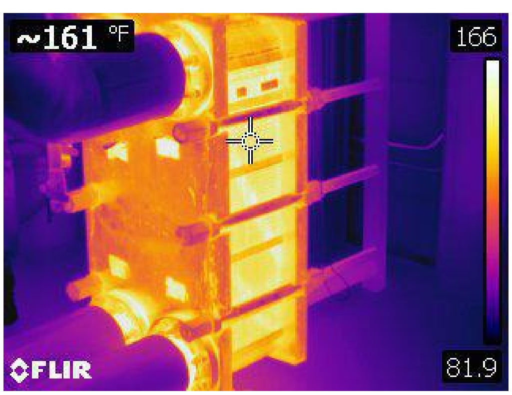

Figure 1 This is an example infrared photo of a heat exchanger showing the areas with where large temperature differences create high rates of heat transfer.

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 of missing insulation 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

General findings

Condition of the mechanical insulation systems is moderate to poor; there are many deficiencies if we compare the systems to the standards established in Best Practices Guideline[2] developed by TIAC. For instance, valves, pumps, flanges and fittings are without insulation applied. Outdated, hazardous and ineffective insulation materials are also used throughout the complex namely fiberglass, and asbestos. We also noted that due to ongoing maintenance there are areas where insulation materials have been removed and not replaced. 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.

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 improve personnel safety.

[2] Refer to Ashrae 90.1 for more information in mechanical insulation systems.

Upper Level Powerhouse

We have assessed the upper level of the powerhouse and found that insulation was generally applied correctly and the majority of insulation that's applied is in good condition. However, the issue remains that insulation is missing on piping, valves, strainers and heat exchangers. Failure to have complete coverage of the insulation system has left opportunities to improve or upgrade the insulation and receive benefits to the cost of operation. We noted that the insulation is a combination of 1 inch thick (25mm), 1 ½ inches thick (40mm), 2 inches thick (50mm) and 3 inches thick (75mm). Current best practices and ASHRAE 90.1 (2010) requires that the insulation applied to heating systems be minimum of 1 ½ inch thick (40mm)or greater. There are areas where new insulation that has been applied on upgraded mechanical heating systems that follows ASHRAE 90.1 but the installers did not completely insulate the systems leaving minor opportunities to save energy and lower GHG output.

During the inspection of the powerhouse upper level we counted at least (9) valve bonnets, (14) hangers, (4) PSVs, (17) flanges, (3) steam traps (8) pipe unions and (1) vessel manway that should be insulated.

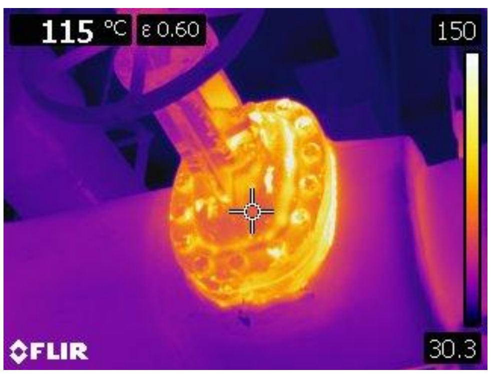

Figure 3 This is a thermographic image of an exposed valve bonnet at 115º C, or 239º F.

Figure 4 This is a conventional photo of the same exposed valve bonnet.

Figure 5 This thermographic image of a roller hanger at a temperature greater than 150º C or 302º F.

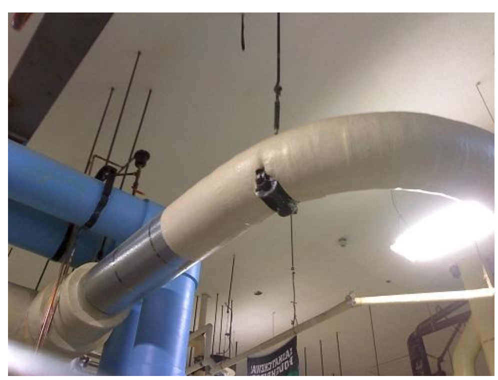

Figure 6 This conventional photo shows the same piping roller hanger.

Figure 7 This is a thermographic image of a bare PSV at 138º C or 191º F.

Figure 8 This is a conventional photo of the same piping and valve.

Figure 9 This is a thermographic image of bare flange in the powerhouse at 143º C or 290º F.

Figure 10 This is the conventional image of the same bare flange and piping.

Figure 11 This is a thermographic image of a steam trap at a temperature greater than 150º C or 302º F.

Figure 12 This is the conventional image of the same steam trap.

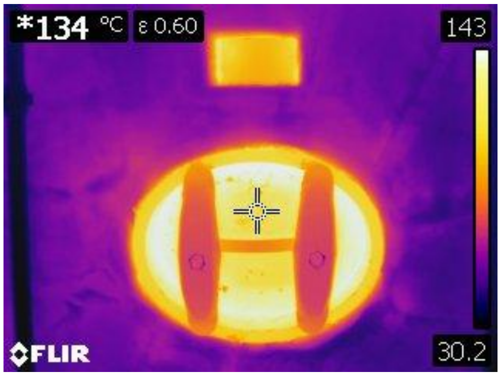

Figure 13 Thermographic image of a bare manway at 134º C or 134 ºF

Figure 14 Conventional image of the same manway on tank.

Figure 15 This thermographic image is of a bare pipe union at 138º C or 280º F

Figure 16 Conventional image of the same pipe union.

Figure 17 Thermographic image of un finished elbows and piping at 114º C or 237º F

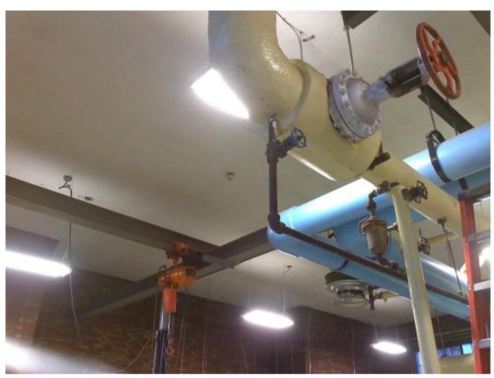

Figure 18 Conventional image of the same elbows and piping.

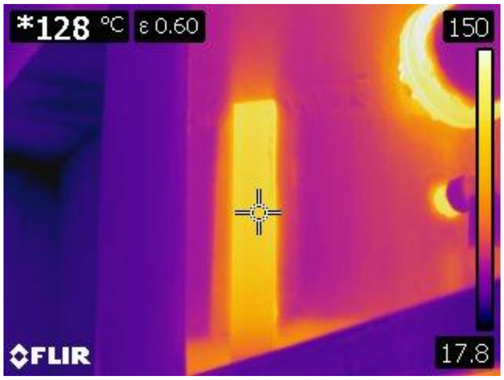

Figure 19 Thermographic image of the bare vessel support at 128º C or 262º F

Figure 20 Conventional image of the same support.

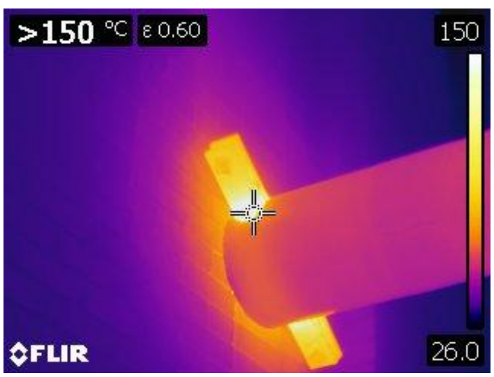

Figure 21 Thermographic image of a pipe support at a temperature greater than 150º C or >302º F.

Figure 22 Conventional image of the same pipe support.

Figure 23 Thermographic image of a flange at 139º C or 282º F.

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Figure 24 Conventional image of the same flange.

Lower Level Powerhouse

The inspection of the lower level powerhouse mechanical areas has revealed that the insulation was generally applied correctly and much of the insulation applied is in moderate condition. However, areas were found where pipe covering is in very poor condition, and is burnt out due to heat exposure. The same issue as the upper floor remains that insulation is missing on piping, vessels, valves, flanges, hangers, and pumps. It should also be noted that fiberglass insulation is used on a majority of the pipes, and systems. An insulation product that contains mineral wool (ex. Roxul.) would be much more applicable, as well as effective as it is designed for the high temperatures we see in the plant. (figures 25-40)

During the inspection of the powerhouse lower level we counted at least (24) valve bonnets, (15) hangers, (6) pumps, (4) PSVs, (15) flanges, (1) small vessel (2) steam traps and (4) pipe unions that should be insulated. In addition to (180) ft of exposed copper line, and (100) ft of exposed iron pipe.

Figure 25 Thermographic image of a valve bonnet at a temperature greater than 150º C or >302º F.

Figure 26 conventional image of the same valve bonnet. Note the burnt pipe covering.

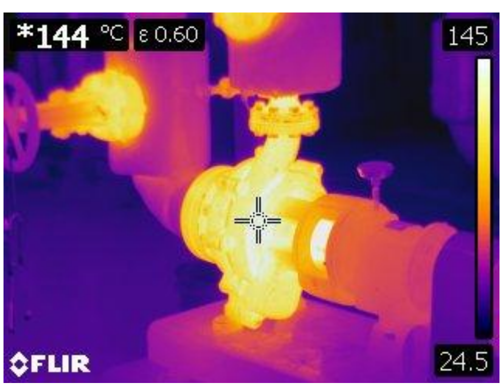

Figure 27 Thermographic image of pump at 144º C or 291º F.

Figure 28 Conventional image of the same pump.

Figure 29 Thermographic image of a small vessel at 65º C or 149º F.

Figure 30 Conventional image of the same vessel.

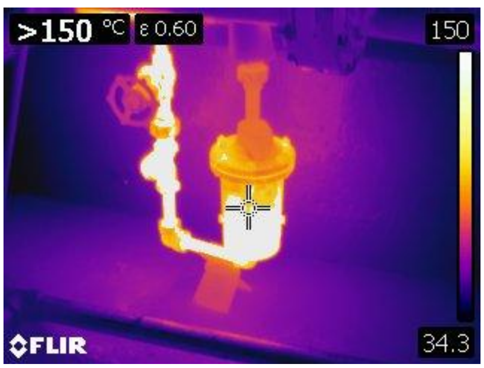

Figure 31 Thermographic image of a steam trap at a temperature greater than 150º C or >302º F.

Figure 32 Conventional image of the same piping.

Figure 33 Thermographic image of an elbow with older fiberglass insulation and PVC covering at 81.5º C or 178º F.

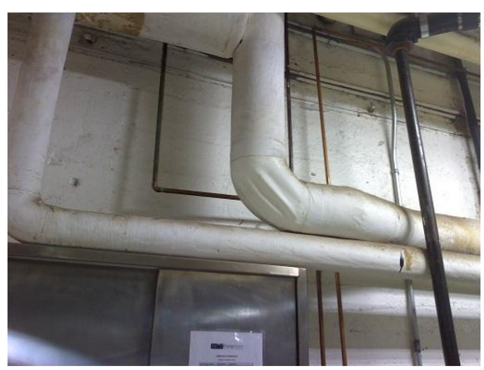

Figure 34 Conventional image of the same elbow. Note how the PVC elbow is melted from heat.

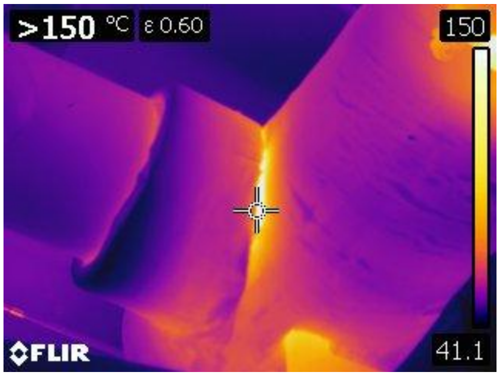

Figure 35 Thermographic image of insulated piping at a temperature greater than. 150º C or 302º F.

Figure 36 Conventional image of the same insulated piping. Note how the canvas is burned due to the heat.

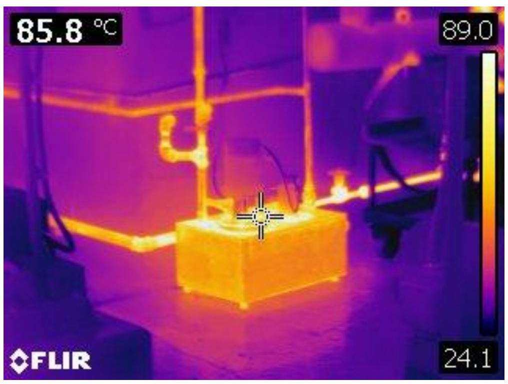

Figure 37 Thermographic image of a box at 85.8º C or 186º F.

Figure 38 Conventional image of the same box. Note the uninsulated copper lines in the same area.

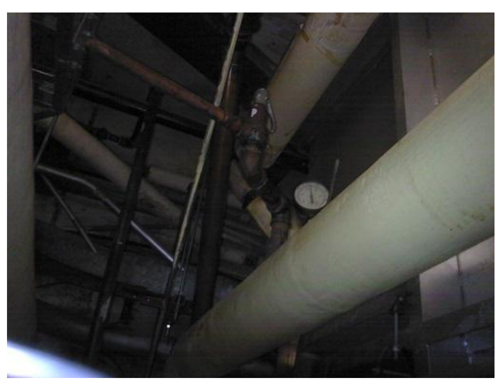

Figure 39 Thermographic image of bare copper pipe at 139º C or 282º F.

Figure 40 Conventional image of bare copper pipe.

Furnace Room

The inspection of this furnace room has revealed that the insulation was not applied to many of the lines. The lines that are insulated are in poor condition and may need the insulation replaced. Insulation is missing on piping, valves and flanges, and is degraded in several places. Failure to have complete coverage of the insulation system has left opportunities to improve or upgrade the insulation and receive benefits to the cost of operation. (figures 41-54)

During the inspection of the furnace room we counted at least (33) valve bonnets, (14) hangers, (1) pumps, (4) PSVs, (64) flanges, (9) pipe unions (1) steam traps and that should be insulated. In addition (40) ft. of exposed pipe.

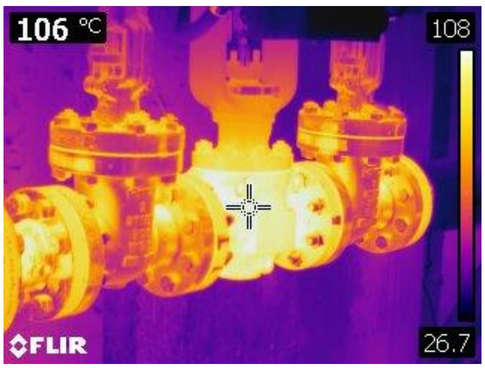

Figure 41 Thermographic image of bare valves at a temperature of 106º C or 223º F.

Figure 42 Conventional image of the same valve.

Figure 43 Thermographic image of bare pipe and flange at a temperature of 99.3º C or 211º F

Figure 44 Conventional image of the same piping and flange.

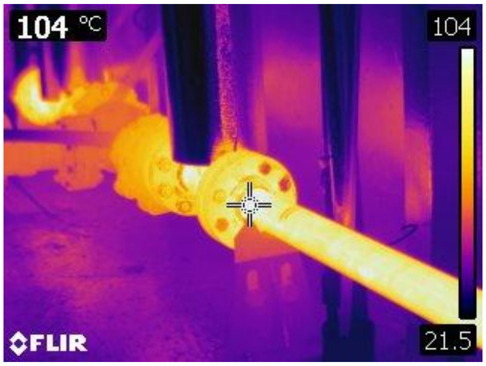

Figure 45 Thermographic image of bare piping and flanges at 104º C or 219º F.

Figure 46 Conventional image of the same piping.

Figure 47 Thermographic image of bare valve bonnets at 131º C or 267º F.

Figure 48 Conventional image of bare vale bonnets. Note the canvas is burnt due to exposure to high temperatures.

Figure 49 Thermographic image of bare valve bonnets and a pressure reducing valve at 119º C or 246º F

Figure 50 Conventional image of valve bonnets.

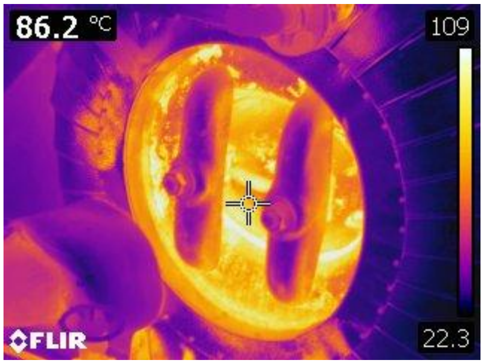

Figure 51 Thermographic image of bare manway at 86.2º C or 187º F

Figure 52 Conventional image of the same bare manway on the upper level of the furnaces.

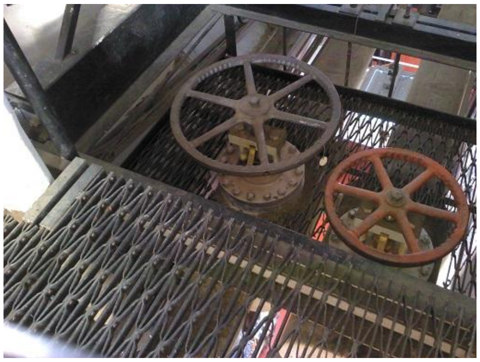

Figure 53 Thermographic image of a valve greater than 150º C or 302º F

Figure 54 Conventional image of the same valve.

Legislative Tunnel

The inspection of the legislative tunnel revealed that the insulation applied to many of the lines was in poor condition, and may need the insulation to be replaced. Insulation is missing on piping, shoes, hangers, valves and flanges, and is degraded and has been removed in several places. Failure to have complete coverage of the insulation system has left opportunities to improve or upgrade the insulation and receive benefits to the cost of operation. It should be noted that some of the lines in this tunnel are insulated with materials containing Asbestos, and any work done in the area should be done with extreme caution and by properly trained individuals. (figures 55-74)

During the inspection of this tunnel we counted at least (70) pipe shoes, (103) roller supports, (20) blue pipe rack supports, (4) steam traps, (18) valves of various sizes, and (4) flanges of various sizes that were missing insulation.

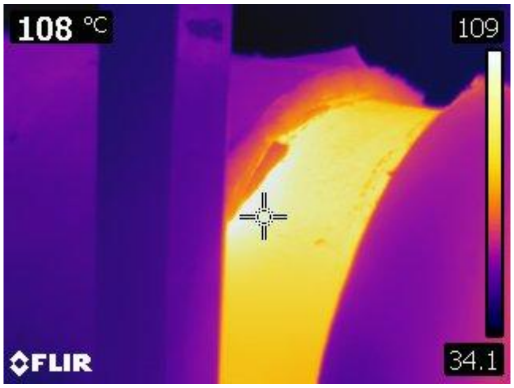

Figure 55 Thermographic image of a bare pipe shoe at 108 º C or 226º F

Figure 56 Conventional image of the same shoe.

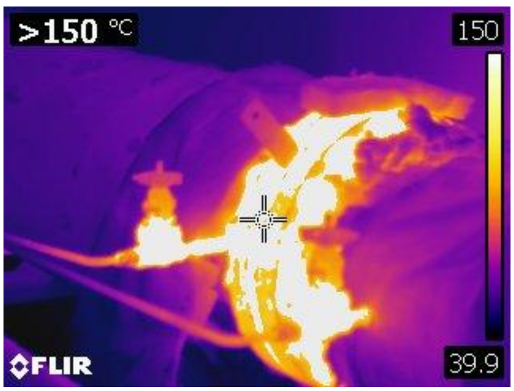

Figure 57 Thermographic image of bare flange and small valve greater than 150º C or 302º F

Figure 58 Conventional image of the same flange and valve.

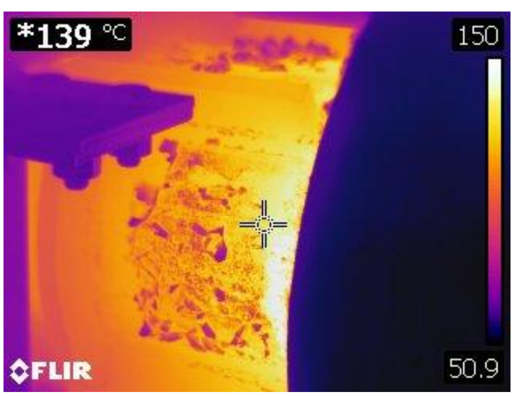

Figure 59 Thermographic image of bare pipe rack support at 139º C or 282º F

Figure 60 Conventional image of the same pipe rack support.

Figure 61 Thermographic image of bare flange greater than 150º C or 302º F

Figure 62 Conventional image of the same flange.

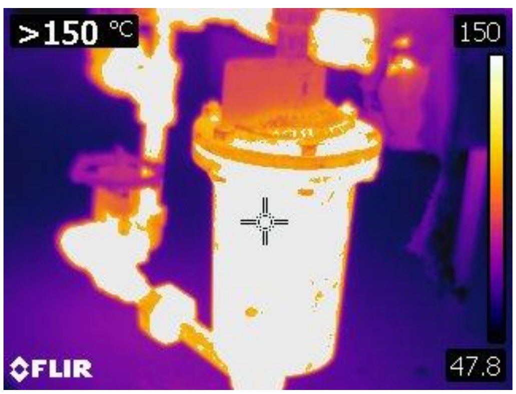

Figure 63 Thermographic image of bare steam trap greater than 150º C or 302º F.

Figure 64 Conventional image of the same steam trap.

Figure 65 Thermographic image of bare valve at 122º C or 252º F.

Figure 66 Conventional image of the same valve.

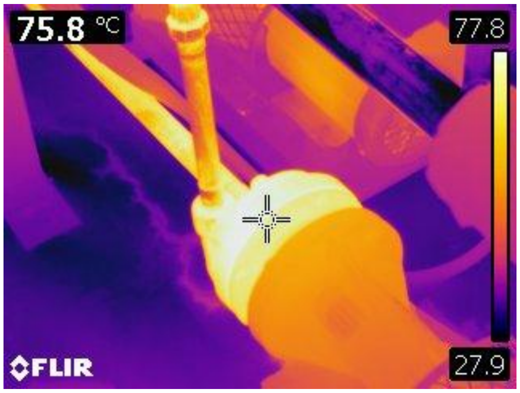

Figure 67 Thermographic image of bare pipe and flanges at 75.8º C or 168º F

Figure 68 Conventional image of the same piping and flanges.

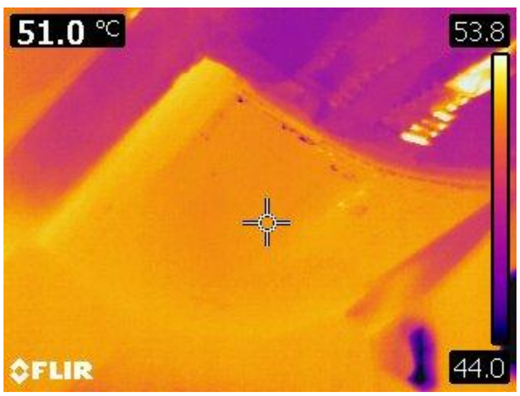

Figure 69 Thermographic image of a bare roller support at 51º C or 124º F

Figure 70 Conventional image of the same roller support.

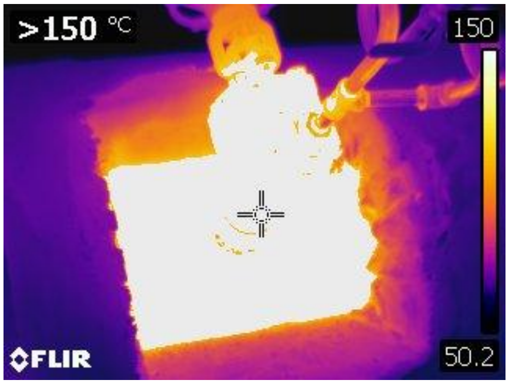

Figure 71 Thermographic image of a bare section of pipe and valve greater than 150º C or 302º F

Figure 72 Conventional image of the same pipe and valve.

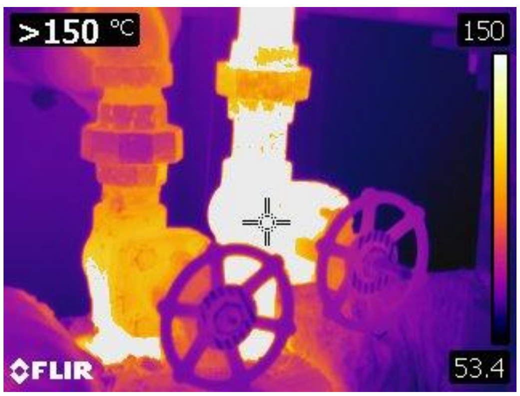

Figure 73 Thermographic image of uninsulated valves greater than 150º C or 302º F

Figure 74 Conventional image of the same valves.

Walter Scott Tunnel

The inspection of the Walter Scott tunnel revealed that the insulation applied to many of the lines was in poor condition, and may need the insulation to be replaced. Insulation is missing on piping, shoes, hangers, valves and flanges, and is degraded and has been removed in several places. Failure to have complete coverage of the insulation system has left opportunities to improve or upgrade the insulation and receive benefits to the cost of operation. It should be noted that some of the lines in this tunnel are insulated with materials containing Asbestos, and any work done in the area should be done with extreme caution and by properly trained individuals. (figures 75-88)

During the inspection of this tunnel we counted at least (36) pipe shoes, (1) Valve, (2) flanges, and various piping/heat exchangers that all were uninsulated.

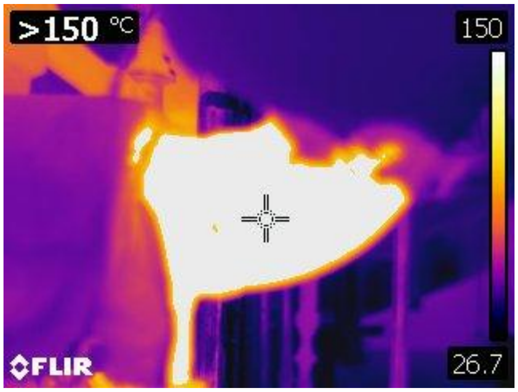

Figure 75 Thermographic image of an uninsulated elbow greater than 150º C or 302º F.

Figure 76 Conventional image of the same elbow.

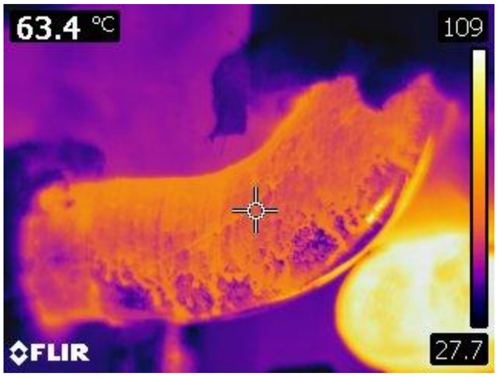

Figure 77 Thermographic image of an uninsulated elbow at 63.4º C or 146º F

Figure 78 Conventional image of the same bare elbow.

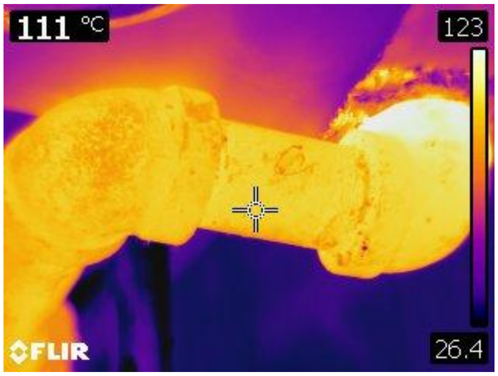

Figure 79 Thermographic image of an uninsulated 2" pipe at 111º C or 232º F

Figure 80 Conventional image of the same pipe.

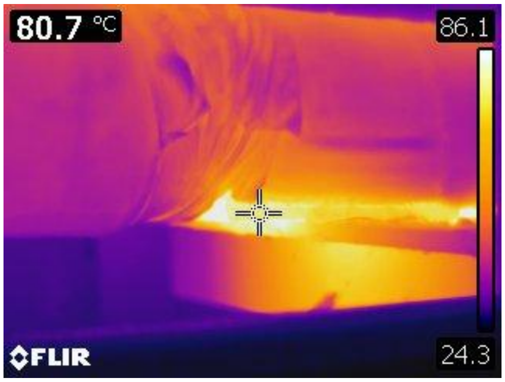

Figure 81 Thermographic image of an improperly insulated pipe shoe at 80.7º C or 177º F

Figure 82 Conventional image of the same shoe.

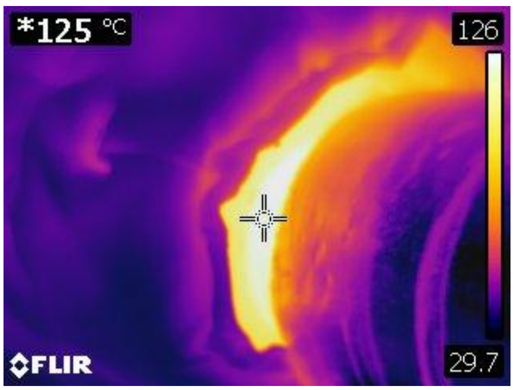

Figure 83 Thermographic image of an improperly insulated heat exchanger at 125º C or 257º F

Figure 84 Conventional image of the same exchanger.

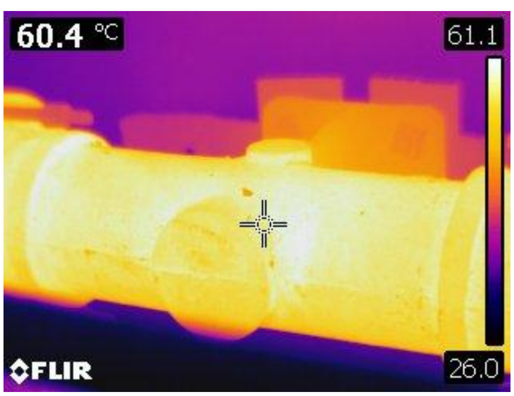

Figure 85 Thermographic image of a bare heat exchanger at 60.4º C or 141º F

Figure 86 Conventional image of the same exchanger.

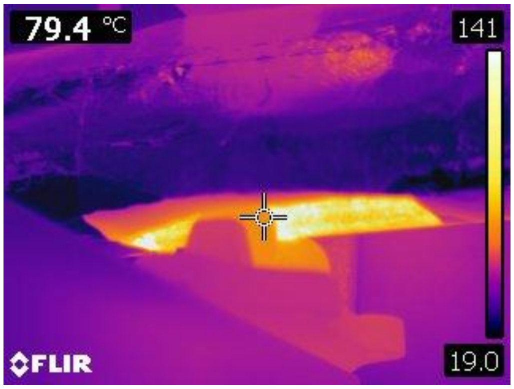

Figure 87 Thermographic image of an uninsulated roller support at 79.4º C or 175º F

Figure 88 Conventional image of the roller support.

Wascana Rehab and T.C Douglas tunnel

The inspection of the Wascana rehab and T.C Douglas tunnels revealed that the insulation applied to many of the lines was in poor condition, and may need the insulation to be replaced. Insulation is missing on piping, shoes, hangers, valves and flanges, and is degraded and has been removed in several places. Failure to have complete coverage of the insulation system has left opportunities to improve or upgrade the insulation and receive benefits to the cost of operation. It should be noted that some of the lines in this tunnel are insulated with materials containing Asbestos, and any work done in the area should be done with extreme caution and by properly trained individuals. (figures 89-112)

During the inspection of these tunnels we counted (45) valves of various sizes, (9) steam traps, (5) pipe unions, (1) sump pump, various expansion joints, and 60’ of piping that were all uninsulated.

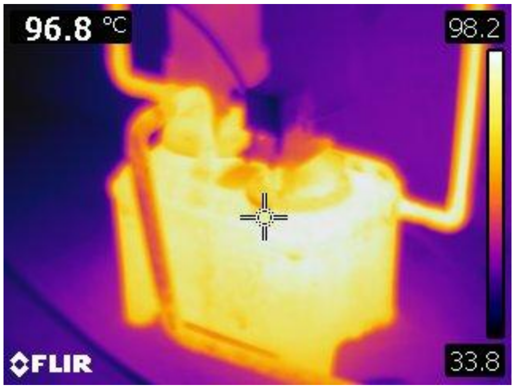

Figure 89 Thermographic image of an uninsulated sump pump at 96.8º C or 206º F

Figure 90 Conventional image of the same sump pump.

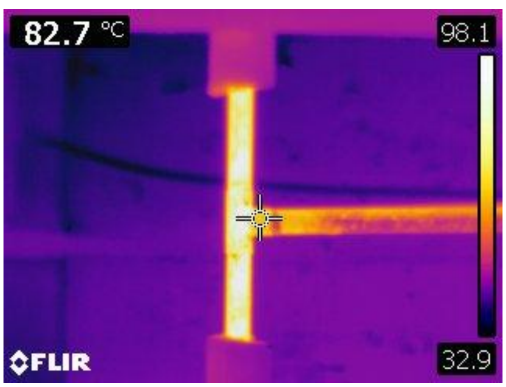

Figure 91 Thermographic image of bare piping at 82.7º C or 181º F

Figure 92 Conventional image of the same bare piping.

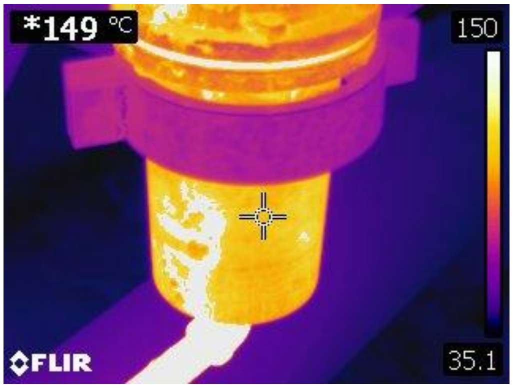

Figure 93 Thermographic image of an uninsulated steam trap at 149º C or 300º F

Figure 94 Conventional image of the same steam trap.

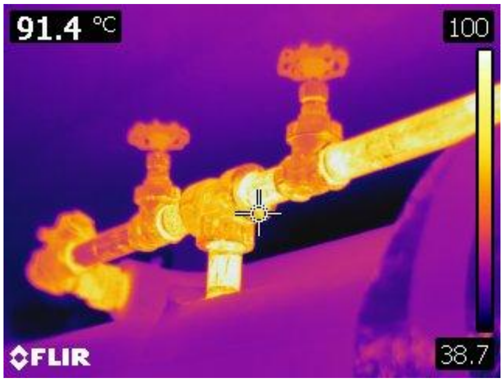

Figure 95 Thermographic image of bare piping and valves at 91.4º C or 197º F

Figure 96 Conventional image of the same piping and valves.

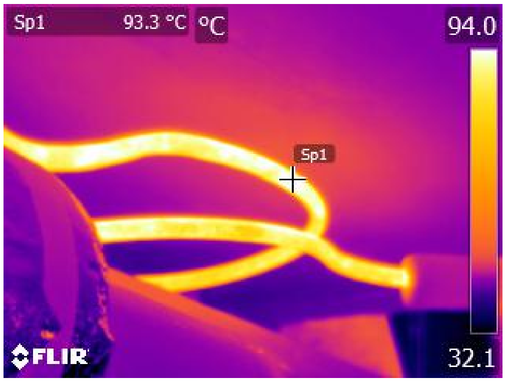

Figure 97 Thermographic image of uninsulated piping at 93.3º C or 200º F

Figure 98 Conventional image of the same piping.

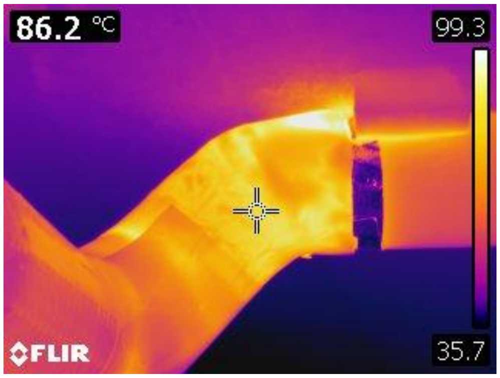

Figure 99 Thermographic image of improperly insulated piping where the outside surface temperature is 86.2º C or 187º F

Figure 100 Conventional image of the same piping, note that the PVC jacketing on the material is melting.

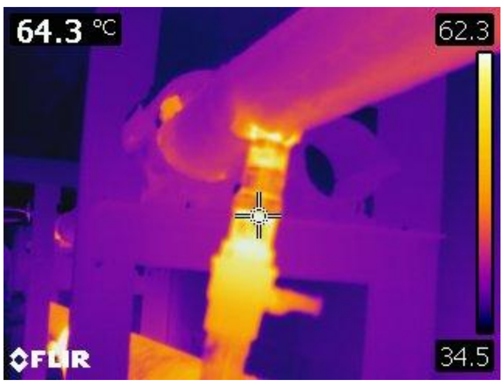

Figure 101 Thermographic image a bare valve at 64.3º C or 148º F

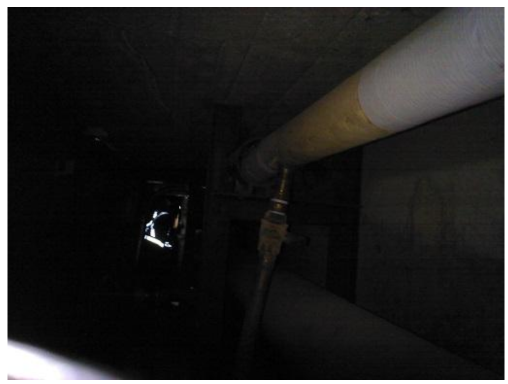

Figure 102 Conventional image of the same valve.

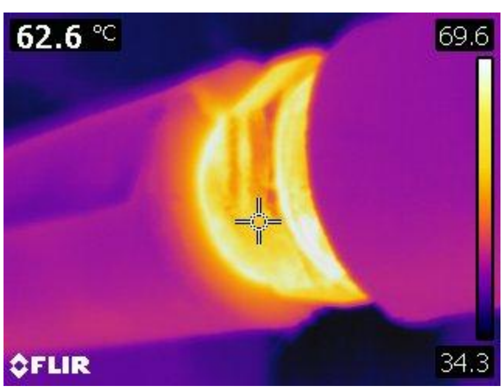

Figure 103 Thermographic image of a bare piping union at 62.6º C or 145º F

Figure 104 Conventional image of the same union.

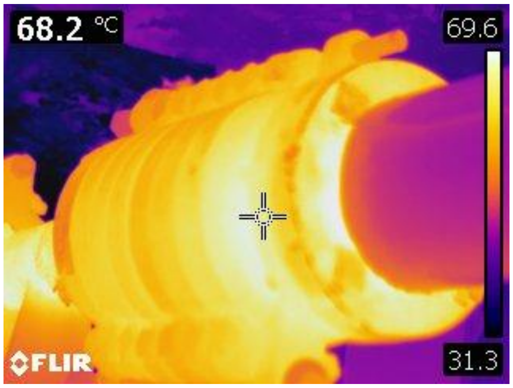

Figure 105 Thermographic image of an uninsulated expansion joint at 68.2º C or 155º F

Figure 106 Conventional image of the same expansion joint.

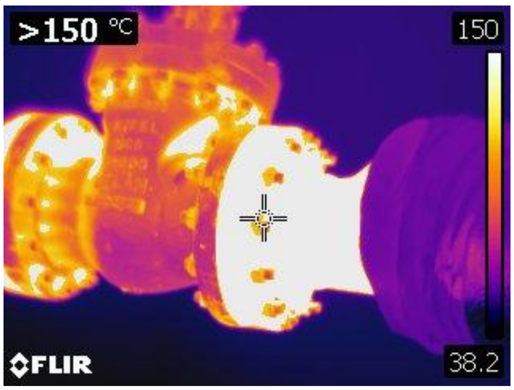

Figure 107 Thermographic image of an uninsulated valve at a temperature greater than 150º C or 302º F

Figure 108 Conventional image of the same valve.

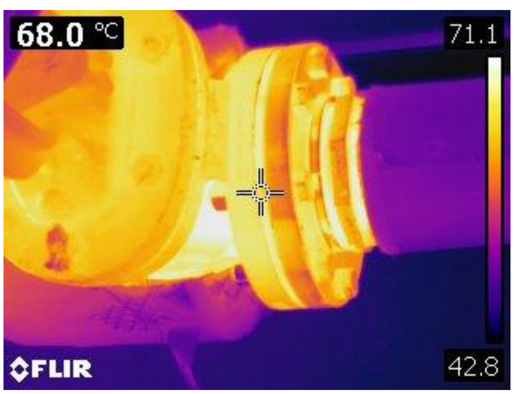

Figure 109 Thermographic image of an uninsulated valve at 68º C or 154º F

Figure 110 Conventional image of the valve.

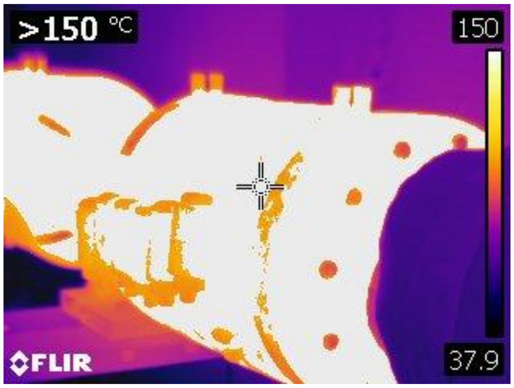

Figure 111 Thermographic image of an uninsulated expansion joint greater than150º C or 302º F

Figure 112 Conventional image of the same expansion joint.

Personnel Protection

It is also important to recognize the hazards that hot exposed surfaces present to personnel. The powerhouse and associated tunnels generally are packed with equipment and piping operating at temperatures 60-150C. (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.

Asbestos

In the process of inspection asbestos was observed in many areas. Some of these areas are clearly marked and others are not. We observed a number of areas which were asbestos containing that are damaged and these areas need to be addressed for the protection of all workers. Areas such as the tunnels have debris lying on the floor which may contain asbestos materials.

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	Gigajoules Saved
8760	**Powerhouse – 1,705,882.7**	**6141**
	Tunnels – 299,077.88	**1077**
	Total – 2,004,960.58	**7218**
	Cost of fuel – $2.15	**Annual Cost Reduction $15,518.70**

Insulation Materials

Table 3.0 provides a list of materials needed to insulate the mechanical systems in the powerhouse and all associated tunnels 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	272.28 sq. ft. @ $ 2.75	$ 748.77
3/4	89 ft. @ $ 17.92	$ 1594.88
1	273.7 ft. @ $ 18.08	$ 4948.49
2	82.41 ft. @ $ 19.35	$ 1594.63
3	153.1 ft. @ $ 20.63	$ 3158.45
4	223.2 ft. @ $ 21.88	$ 4883.61
6	254.05 ft. @ $ 24.14	$ 6132.76
8	72.11 ft. @ $ 26.59	$ 1917.40
10	62.12 ft. @ $ 29.56	$ 1836.26
12	75.94 ft. @ $ 31.65	$ 2403.50
14	21.86 ft @ $ 33.87	$ 740.39
	Total	**$ 29,959.14**

It should be noted that this list is materials inventoried for all areas of the powerhouse, and should any work be done in the tunnels there may be extra costs involved due to the limited access and presence of hazardous materials (Asbestos). All materials 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 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 before commencing any work, to get three quotes to compare. This price is an estimate only and may not be considered an exact amount.

Insulation thickness

It should be noted that all calculations were completed with 1.5" of insulation thickness, this allows for standardized baseline calculations at a minimum recommended thickness. Increasing the thickness of insulation on pipes and equipment will increase savings, further reduce heat loss, and GHG emissions. Below we have provided several examples of calculations for upgraded thickness.

Equipment	Insulation	Hours per year	Process temperature	Insulation footage	Heat loss bare	Energy Cost bare	Upgraded thickness	Heat Loss Insulated	Energy Cost insulated
12" valve	Mineral fibre	8760h	302 º F	3'	15960	$43.44	**1.5"**	1229	$3.34
12" valve	Mineral fibre	8760h	302 º F	3'	15960	$43.44	**2"**	881	$2.67
12" valve	Mineral Fibre	8760h	302 º F	3'	15960	$43.44	**3"**	716	$1.95

Equipment	Insulation	Hours per year	Process temperature	Insulation footage	Heat loss bare	Energy Cost bare	Upgraded thickness	Heat Loss Insulated	Energy Cost insulated
8" PSV	Mineral fibre	8760h	267º F	3'	8560	$23.29	**1.5"**	711	$1.94
8" PSV	Mineral fibre	8760h	267º F	3'	8560	$23.29	**2"**	570	$1.55
8" PSV	Mineral Fibre	8760h	267º F	3'	8560	$23.29	**3"**	408	$1.11

Equipment	Insulation	Hours per year	Process temperature	Insulation footage	Heat loss bare	Energy Cost bare	Upgraded thickness	Heat Loss Insulated	Energy Cost insulated
6" steam trap	Mineral fibre	8760h	221 º F	1'	4509	$12.27	**1.5"**	402	$1.09
6" steam trap	Mineral fibre	8760h	221 º F	1'	4509	$12.27	**2"**	314	$0.85
6" steam trap	Mineral Fibre	8760h	221 º F	1'	4509	$12.27	**3"**	235	$0.64

Equipment	Insulation	Hours per year	Process temperature	Insulation footage	Heat loss bare	Energy Cost bare	Upgraded thickness	Heat Loss Insulated	Energy Cost insulated
6" flange	Mineral fibre	8760h	302 º F	3'	8733	23.77	**1.5"**	750	$2.04
6" flange	Mineral fibre	8760h	302 º F	3'	8733	23.77	**2"**	586	$1.59
6" flange	Mineral Fibre	8760h	302 º F	3'	8733	23,77	**3"**	438	$1.19

As the above examples demonstrate, upgrading from 1.5" thickness to 2" results in an approximate 20% decrease in heat loss, and from 1.5" thickness to 3" an approximate 40% decrease in heat loss. These numbers fluctuate somewhat depending on equipment size and temperature, however the percentages show an average example of savings.

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 - **7218 GJ**
2) Annual Greenhouse Gas Reduction **– CO2 – 358 NOx 1.9**
3) Annual cost savings derived through properly insulated piping - **$15,518.70**
4) Potential savings on maintenance costs for equipment
5) Elimination of personal protection hazards Disclosure
6) We have no relevant financial or non-financial relationships to disclose.

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

[3] Ibid.

guaranteed. The results are intended to portray a reasonable estimate of potential energy savings with the use of an upgraded and maintained insulation system.

Closing Comments.

Should you choose to complete the improvements and repairs we have outlined in this report, and submit them to tender; it is our opinion that it should be completed by qualified and skilled tradesmen who have a Red-Seal endorsement. This ensures the use of qualified and properly trained individuals trained through the Saskatchewan Trades and apprenticeship commission.

We also highly recommend the use of language in the specifications that enforces this, as it helps ensure a high quality of workmanship. Here is an example of language that fills this requirement that we have encountered on other projects in Saskatchewan "*Installer Qualifications: Installers shall be Red Seal endorsed Insulators (Heat and Frost) journeypersons or an indentured apprentice working under the direct supervision of.*"

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

Best regards,

Report prepared by: Salamander Inspections Ltd.

Bob Barter	Rodrick Alberton	Shayne Chambers
(Project Coordinator)	(Energy Appraiser)	(Energy Appraiser)

Reviewed by:
Besant and Associates Engineers Ltd.

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