Fuel Oil Heating Installation Inspection Report #2

Prepared for the:

Yukon Government:

Yukon Housing Corporation and
The Energy Solutions Centre

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Executive Summary

NRG Resources Inc. reviewed and interpreted 69 inspections of oil-burning appliances and supply tanks employing the same criteria used in the first "Fuel Oil Inspection Report" dated March 30, 2007. The 69 inspections were conducted by Carmon Whynot from Yukon Housing using the forms and procedures developed by NRG Resources. This report provides additional evidence of the state of oil-burning appliance installations in the Yukon as well as providing a comparison with the first report.

The 69 inspections were conducted at residential sites in Whitehorse (with one except in Teslin) between February and May, 2007 as part of a survey for the Yukon Government, Yukon Housing Corporation, and Energy Solutions Centre. Like the first survey, this survey was conducted to determine the level of compliance with the B139 *Installation Code for Oil-Burning Equipment* and to identify safety and efficiency issues.

The inspection survey identified 366 infractions of the B139 Code of which 204 were considered to be significant concerns that either posed an imminent hazard (6 cases) or could reasonably be expected to develop into a problem in the future. The average number of code infractions per site was 5.3 and the average number of significant infractions was 3.0 per site.

The major safety and efficiency issues identified by the survey and listed in order of importance are:

1. Lack of maintenance.
2. In over 70% of the cases, the owners indicated that the installers or service technicians are <u>not</u> trained and qualified as licenced Oil Burner Mechanics. It is suspected that the percentage of non-compliance with licencing requirements is significantly higher.
3. Spillage of flue gases indoors due to improperly installed appliances and/or their venting systems.
4. 31% of appliances were improperly set-up for safe, efficient combustion.
5. Improperly sized, installed, or maintained vent systems.
6. Clearance to combustibles is not met during installation or not maintained.
7. Lack of air supply to appliances.
8. Aboveground tanks not installed or maintained properly to prevent internal and external corrosion.
9. Aboveground tanks not installed or secured to prevent toppling or damage - especially if a seismic event occurs.
10. Lack of monitoring of underground tanks for leakage and corrosion.

The findings from the 69 inspections are <u>very</u> similar to the results of the first survey of 55 sites as discussed in the final section of this report. Although the same three recommendations from the first report apply equally to this survey, a separate report will be issued in October 2007 with a more detailed discussion of ways to improve the general safety and efficiency of oil burning equipment installations in the Yukon.

Survey Procedure

The inspection sites were selected by Energy Solutions Centre and Yukon Housing Corporation from a list of home owners who responded to an advertisement concerning the inspection program. The selection criterion was primarily a "first call – first chosen" basis although some consideration was given to selecting a wide variety of ages and types of installations.

All 69 inspections were conducted by Carmon Whynot from Yukon Housing although various employees from Yukon Housing assisted Carmon during these inspections. The inspections were conducted between February and May, 2007. It is worth highlighting that Carmon did an excellent job of conducting and recording the inspections for this second survey.

The same inspection forms and procedures employed during the first survey were used in this second survey. The forms and procedures were developed by NRG Resources and approved by Yukon Housing and Energy Solutions Centre. Blank copies of these forms are found in Appendix A and the completed forms for each site are found in Appendix C.

Only a visual inspection of the oil-burning appliances, supply tanks, and supply lines was conducted at each site. No adjustments or changes to the equipment were made during the inspection. Combustion analyses were conducted on 61 of the 71 appliances inspected. Ten of the appliances were not tested since they would have required significant changes to the appliances to conduct the tests.

The owner or occupant was in the house at the time of the inspection. A summary of the inspection findings was provided to the owner/ occupant. Any safety or efficiency concerns were discussed with the owner/occupant. Where corrective action was warranted, the owner/occupant was advised to have a qualified heating contractor of their choice conduct the work.

Interpretation Criteria

The criteria employed to interpret the inspection results regarding code compliance was the B139 Code in effect at the time of the installation. This criteria required reference to four editions of the B139 Installation Code for Oil Burning Equipment, namely: B139-1976 (in effect from 1976 to 1991); B139-M91 (in effect from 1991 to 2000); B139-00 (in effect from 2000 to 2006); and the current B139-04 in effect in the Yukon since April 2006). Installations dating from before 1976 have all been upgraded in some way and therefore were judged by the Code in effect at the approximate time of the upgrade.

Four exceptions were made to the above inspection criteria regarding reference to the Code in effect at the time of the installation. In all four cases (listed below) the current Code requirements were employed to identify the infraction since the condition poses a potential hazard that should be corrected even though it is technically in compliance with the Code at the time of installation.

Interpretation Criteria (continued)

The four exceptions were:

1. The slope of the tank toward the outlet.
   - Although this requirement only appears in the B139-04 edition, it has been required by manufacturer's instruction in compliance with the S602 tank Standard since the early 1990's. Significant corrosion can occur inside the tank due to the collection of water and sludge when the tank is sloped away from the outlet.
2. The height of a tank fill pipe shall be at least one meter (3') above grade.
   - Again, this requirement only appears in the B139-04 edition. However, the corrosion problems posed by snow or water entering a tank warrant the identification of this poor installation practice as a code infraction.
3. Piping, valves, or filters shall not extend below the tank foundation.
   - Although this requirement only appears in the B139-04 edition, it has been required by manufacturer's instruction since the early 1990's. Since piping, valves, or filters that extend below the tank foundation could snap off as the tank settles, it is reasonable and responsible to identify this problem as a code infraction.
4. Piping and tubing shall not be buried in cement unless installed in a duct.
   - This requirement was explicitly made in the B139-00 edition but previous code requirements to protect oil lines from corrosion could be interpreted as prohibiting this practice. The potential for corrosion and leakage warrants the identification of this poor installation practice as a code infraction.

Combustion Efficiency Criteria

The criteria for judging whether the combustion efficiency of an appliance was "acceptable" was the guideline established in Canada's Energy Efficiency Act and Regulations which requires oil-fired furnaces with an input of ≤ 225,000 Btuh to have an efficiency of 78% or greater.

The combustion setup requirements established by the B139 Code and the appliance manufacturer's certified instructions were also factored into the assessment as to whether the efficiency of an appliance was "acceptable". Inefficient appliances (i.e. <78%) were not considered to be an infraction of the B139 Code unless they were in non-compliance with the combustion setup requirements of the B139 Code or the manufacturer's certified instructions.

Code Infraction Reporting Criteria

The criteria for identifying the code infractions found during the survey can be characterized as reasonable and practical. Not all code infractions found during the inspections are identified. Only those code infractions that could reasonably be considered as safety or efficiency issues are identified on the individual inspection reports found in Appendix C and summarized on the table found in Appendix B.

Minor code infractions that could not affect the safety or efficiency of the installation are not identified in this report. For example, the B139-1996 Code and the B139-M91 Code both required that a tank vent pipe terminate at least seven feet above grade. The B139-00 and B139-04 editions of the Code only require the vent pipe to terminate 150mm (6") above the fill pipe.

The recent code requirements were employed to identify infractions related to vent pipe termination since the technical or legal requirement to comply with the code in effect at the time of installation would "clutter" the report with inconsequential infractions that might obscure the important safety and efficiency issues identified in the survey.

In regards to underground storage tank (UST) requirements, the 2004 edition of the B139 Code is the first fuel oil code that has no requirements regarding the installation, maintenance, or removal of underground tanks. Currently, USTs must only comply with the National Fire Code of Canada and the CCME Environmental Code. The same is true for aboveground tanks with a capacity greater than 2500L.

For the purpose of this report, the requirements for underground tank installations from previous editions of the B139 Code were employed since all 7 of the UST inspected during this survey pre-date the current B139 Code.

The Code infractions summarized on the table found in Appendix B are separated into two categories as follows:

1. **Significant Code Infractions**: These are code infractions that were considered to be safety concerns that either posed an imminent hazard or could reasonably be expected to develop into a problem in the future.
2. **Minor Code Infractions**: These are code infractions that were considered to be worth identifying since they should have been corrected during installation or maintenance of the appliances. However, they should not pose a problem under "normal" conditions.

Types of Sites and Equipment Inspected

All 69 sites inspected were single family dwellings.

The ages of the installations ranged from the 1976 to early 2005. All but one site was in Whitehorse; one installation was in Teslin.

The types and age range of equipment inspected are listed below:

Appliance Type	Total	Unknown Date	1960 to 1979	1980 to 1989	1990 to 1999	2000 to 2005	2006 & 2007
Forced air furnace	51	11	6	6	15	10	3
Boiler	14	3	1	1	4	4	1
Combo Water heater/Space heater	1				1		
Water heater	1				1		
Space heater	4				2	1	1
Aboveground Indoor tank	14	5			6	3	
Aboveground Outdoor tank	48	10			11	21	6
Underground tank	7		1	1	5		
Total Appliances	71	14	7	7	23	15	5
Total Tanks	69	15	1	1	22	24	6

The range of types and ages of the various of equipment inspected are considered representative of residential installations in Whitehorse.

General Overview of Inspection Results

The inspection of 69 sites with oil-burning equipment found a large number of code infractions and efficiency concerns as listed in the table in Appendix B and summarized below.

- None of the 69 sites completely complied with the B139 Installation Code for Oil-Burning Equipment.
- Code infractions related to the oil tank and supply lines were found at all of the sites.
- Code infractions related to the appliances and venting systems were found at all but eight of the sites.
- A total of 366 contraventions of the B139 Code were found at the 69 sites. This constitutes an average of 5.3 code infractions per site.
- 195 or 53% of the total number of code infractions were related to the tank and supply lines. As such, the average number of code infractions per site related to the tank and supply lines was 2.8. A focused discussion of these code infractions is provided in the next section of this report (page 7).
- 171 or 47% of the total number of code infractions were related to the appliances and venting systems. This represents an average of 2.5 code infractions per site related to the appliance and venting system. More information regarding these code infractions is provided on pages 10 to 12 of this report.
- 6 of the 69 sites (9%) were considered “imminent hazards” (i.e. posed a hazard to life or property if not addressed). In all cases, the owners or occupants were advised about these problems. Detailed information regarding these six sites is provided on pages 13 and 16 of this report.
- 62 of the 69 sites (90%) had at least one significant code infraction. A total of 204 significant code infractions were identified. A “significant” code infraction is defined on page 4 of this report.
- 20 of the 61 appliances (33%) tested for proper combustion were found to be inefficient and/or in non-compliance with the code requirements related to combustion set up.
- 46 of the 69 sites (67%) were not being maintained annually as required by Section 14 of the B139 Code.
- An indication from the owner or other source trusted by the inspector that the technician who recently installed or serviced the installation was a licenced Oil Burner Mechanic was recorded at 20 of the sites. As such, at least 49 or 71% of the installation were not installed or maintained by a licenced Oil Burner Mechanic.

Discussion of the Tank Inspection Results

The inspection of 69 sites with 69 oil supply tanks identified 195 code infractions related to the oil tanks and supply lines. This represents an average of 2.8 code infractions per site related to the oil supply systems. All the sites inspected had at least one code infraction related to the tanks and supply lines.

89 (46%) of these 195 code infractions were considered to be "significant" in that they could reasonably be expected to develop into a problem in the future.

The following is a complete list of the types of infractions related to the oil tanks and supply lines as identified on the summary table in Appendix B and the individual inspection forms in Appendix C. Infractions are listed in order of importance with those considered "significant" identified in bold print. Two of the six "imminent hazard" involved tank and oil supply line problems. Although these infractions are included and highlighted in the following table, detailed information on these sites is also provided on pages 13 to 16.

Type of infraction	Number of sites with this infraction	Code Reference	Comments
Signs of oil leakage	**10**	14.2.2	7 oil leaks were found at the tank and its immediate piping. 2 were at the burner, and one at the filter. Although 7 cases were identified as minor leaks, all 10 cases were considered significant since leaks may cause fire and environmental hazards, odour problems, and tend to increase.
Oil lines cemented in or under floor	**2**	8.3.5	See Note #4 on page 3
Tank not sloped toward outlet.	**31**	6.3.9.2 (c)	See Note #1 on page 3
Piping at tank is improper.	**6**	6.3.9.2	See Note #3 on page 3
Tank not protected from corrosion or physical damage	**9**	6.5.4 (a)	2 of these infractions contributed to th imminent hazard rating at [redacted] 7 cases related to painting the tank. 8 of the 9 cases were considered significant.

Discussion of the Tank Inspection Results (continued)

Type of infraction	Number of sites with this infraction	Code Reference	Comments
Oil lines not protected from damage	**3**	8.3.1.5	All cases involved kinks in tubing and were considered significant.
Filter location improper.	**10**	3.10.2	Filters were located outdoors even though it was feasible in all cases to have them indoors. In 2 cases the filters were inaccessible. In one case there was no filter. All cases were considered significant.
Tank supported on combustible material	**3**	6.3.8	All cases used wooden blocks for no good reason. All are considered significant infractions.
Tank not properly supported	**6**	6.3	In four cases the tanks were leaning and the base had settled. One was part of an immediate hazard [redacted] All six were considered significant infractions.
No valve at tank	**1**	8.4.1	This case was considered significant since a means of shutting off oil in an emergency is critical.
Tank fill &/or vent pipe not properly capped	**3**	6.8.2 6.9.1.6	At all 3 sites water could be entering the tank resulting in corrosion or appliance problems. All 3 cases were considered significant infractions.
Tank vent does not terminate above fill	**1**	6.9.1.6	Code requires vent to terminate at least 6" above fill. This is considered a significant infraction.
No whistle in indoor tank	**5**	6.8.9	A whistle is necessary for safe filling in indoor tanks. All of these cases were considered significant.
Tank clearances not met	9	6.3.4 to 6.3.6	One of these cases was considered significant since the tank was not accessible for inspection/ maintenance.
No seismic restraint on aboveground tank	59	6.3.11	One of these sites was considered significant infractions since the tank was elevated
Fill and/or vent pipe too close to ground	2	6.8.6 (c) 6.9.1.7 (b)	See Note #2 on page 3. Both of these cases involved underground tanks.

Discussion of the Tank Inspection Results (continued)

Type of infraction	Number of sites with this infraction	Code Reference	Comments
No Rating Plate on Tank	16	6.2.1.1	Two of these cases was considered significant and contributed to the "imminent hazard" rating at these sites. 12 of these cases were on pre-1980 tanks. Lack of approval may indicate that tank is not built to a Standard.
Underground lines not properly installed	1	8.3.2	This one case, which was not considered significant, was part of an immediate hazard [redacted]
No level gauge in tank	5	6.10.2	Gauge allows for troubleshooting. None of these cases were considered significant.
Tank within 5' of property line	2	6.5.4 (b)	None of these cases were considered significant.
Filter housing not rated for >540°C	5	8.1.1	None of these cases were considered significant.
Tank valve not approved for purpose.	7	8.4.1	None of these cases were considered significant.
Plastic tubing used for vent/fill lines	1	6.8.1 6.9.1.1	This case was not considered significant.

Discussion of Appliance Inspection Results

The inspection of 69 sites with 71 appliances identified 171 code infractions related to the appliances and venting systems. This represents an average of 2.5 code infractions per site related to the appliances and venting systems. All but six of the 69 sites inspected (i.e. 91%) had at least one code infraction related to the appliances and their venting systems.

115 (67%) of these 171 code infractions were considered to be "significant" in that they either posed an imminent hazard or could reasonably be expected to develop into a problem in the future.

The following is a complete list of the types of infractions related to the appliances and venting systems as identified on the summary table in Appendix B and the individual inspection forms in Appendix C. Infractions are listed in order of importance with those considered "significant" identified in bold print. Six sites were considered as posing an imminent hazard. Although these infractions are highlighted in the following table, detailed information on these sites is also provided on pages 13 to 16.

Type of infraction	Number of sites	Code Reference	Comments
Flue gases leaking indoors	**12**	4.2.1 4.2.5.3	6 of these cases were caused by incorrectly installed or maintained vent connectors. 4 were caused by tests ports in positive vent systems not being properly capped. 2 were caused by leaks around appliance ports. 4 of the cases contributed to the minent hazard rating at: [redacted] These cases are described in the next section.
Combustion test results do not meet requirements of the Code and/or manufacturer	**9**	5.1 5.2.2 5.2.3 5.2.5	9 out of 61 appliances tested is a 15% non-compliance rate. 6 of the appliances had efficiency levels above 78% but high CO or smoke readings. 3 appliances were both inefficient and unsafe. 3 of the cases contributed to the imminent hazard rating at: [redacted] hese cases are described in the next section.
Heat exchanger damaged	**1**	14.3.7.3	This was part f the imminent hazard at [redacted]

Discussion of Appliance Inspection Results (continued)

Type of infraction	Number of sites	Code Reference	Comments
Common venting with unapproved wood appliance	**3**	4.1.4	2 of the cases contributed to the imminent hazard rating at: [redacted] These cases are described in the next section.
Sidewall vent installation does not meet requirements of the Code &/or manufacturer	**9**	4.3	Numerous problems including - Vent termination too close - Vent termination too close to opening - Improper joint sealant used - Parts of vent kit not installed - Damaged vent termination 3 of these 9 infractions were considered minor
Appliance too close to combustibles	**11**	7.1.1	6 of these infractions were considered significant. Five of the cases involved storage of material too close to the appliance.
Vent and/or vent connector too close to combustibles	**8**	4.2.5.5 (f)	Five of these infractions were considered significant.
Installation or maintenance of vent liner in chimney or factory vent does not meet Code &/ or manufacturer's requirements	**10**	4.2.2.5.1 4.2.2.9	Infractions included: - No base-tee - No rain cap - Deteriorated vents All 10 of these infractions were considered significant.
Vent connector improperly installed or maintained	**8**	4.2.5	Infractions included: - Vent joints not secured - Vent joints not sealed - Insufficient slope - Too many elbows 7 of these 8 infractions were considered significant.
Vent and/or vent connector too large	**7**	4.2.2.4	5 of these 7 infractions were considered significant.
Barometric damper improperly installed or maintained	**10**	4.2.7.1 4.2.7.3	Infractions included: - No damper installed - Damper not functioning - Damper opening blocked 9 of these infractions were considered significant.

Discussion of Appliance Inspection Results (continued)

Type of infraction	Number of sites	Code Reference	Comments
Return air opening too close to furnace	**1**	14.3.2	This infraction was considered significant.
Appliances not maintained annually	**38**	14.2.1	Annual maintenance was not conducted at 38 of the 69 installations. This represents a 55% non-compliance rate. 25 of these infractions were considered significant since the appliances had either never been maintained or showed obvious signs of problems due to lack of maintenance.
No air supply or improperly sized air supply to appliances	24	4.4.2.1	8 of these 24 infractions were considered significant since they were in confined spaces or in newer, more tightly constructed houses.
Electrical wiring does not meet Code requirements	7	3.7	Infractions included: - Emergency disconnect switch in wrong location or missing - Appliance wiring not secured - Appliance wiring modified None these infractions were considered significant.
Burner not approved with appliance.	5	3.1.1	All of these cases involved upgrades to older burners and controls. Although Codes prior to 1991 allowed this activity under strict guidelines, it is worth highlighting as a minor infraction since it affects the approval of an appliance as discussed in the next row.
No rating plate on appliance	3	3.1.1	One of these sites was considered a significant infraction since it was a new appliance that did not have a Canadian approval label as required. The other two cases involved older appliances. The lack of a rating plate calls into question whether the appliance was tested and approved to a recognized safety standard.

Discussion of Six Imminent Hazard Sites

The code infractions identified at 6 of the inspection sites were considered to pose imminent hazards. Although these sites and infractions were included in the tables provided in the last two sections, they are worth a more detailed discussion since it will highlight the importance of complying with the installation and maintenance requirements fuel oil code. The six sites are listed below:

1. [redacted] Twelve code infractions were identified at this site, of which nine were considered significant. This installation had a 1975 forced air furnace and an outdoor aboveground tank of unknown age. Although the tank had five code infractions (3 of which were significant), the imminent hazard related to the furnace.

The heat exchanger was cracked and could potentially impair combustion and distribute flue gases throughout the house. This dangerous condition was identified to the owner during a service call (unknown date) and confirmed by tests conducted during the survey inspection. The owner indicated to the survey inspector “that he intends to replace the tank [and] is considering a new heating system”. Flue gas spillage from an improperly maintained vent system was also noted at the site.

It is worth noting that there was no indication that the installer or service technician for this site was trained and qualified as an Oil Burner Mechanic. It is also worth noting that the installation was not maintained annually.

This site raises a major concern related to the powers of technicians and inspectors to decisively deal with imminent hazards by shutting down the appliance or ordering corrective action. The owner may be aware of the code infractions but not be knowledgeable about the dangers posed by these infractions.

This case supports all three of the recommendations provided in the first survey report. It especially highlights the need for legislation that would empower technicians and inspectors to require corrective action when imminent hazards are found.

Discussion of Six Imminent Hazard Sites (continued)

2. [redacted] This installation had a 2002 forced air furnace and 500 gallon outdoor aboveground tank of unknown age. Ten code infractions were identified at the site of which six were significant. Both the tank and furnace posed imminent hazards.

The tank was not approved for use as an oil supply tank. It was improperly installed in that it was half buried in the ground and had no visible/accessible shut-off valve. Plastic fill and vent pipes were also used in contravention of the fuel oil code.

The relatively new furnace was improperly common vented with a wood stove that was not approved for this purpose. This is considered a hazard since the venting, operation, and condition of oil furnace could be impaired by the operation of the wood stove.

The furnace was reportedly not installed or serviced by a licenced Oil Burner. There was no indication that combustion tests and setup had ever been conducted on the furnace as required by the fuel oil code after installation and during annual maintenance.

This case also supports all three of the recommendations provided in the first survey report. It especially highlights the need for enforcement of the requirement for properly trained and qualified Oil Burner Mechanics.

3. [redacted] Eleven code infractions, of which nine were considered significant, were identified at this site equipped with a 1982 forced air furnace and outdoor aboveground tank of an unknown age. Both the tank and furnace posed imminent hazards.

The survey inspector noted that “Nothing on the tank is approved and the tank is severely corroded. A new fuel oil tank is required.” Seven code infractions were found related to the tank and supply line of which five were considered significant. The tank was an old underground tank that was “dug up in the ‘80’s, set on cement blocks”. The corrosion and lack of proper support on this tank poses an imminent environmental hazard.

There was no indication that the 25 year old furnace ever had combustion tests or annual maintenance conducted on it. The combustion setup was very inefficient (69%, high draft and high excess air). The combustion air opening was blocked and the barometric damper was not functioning properly. The vent was also deteriorating due to lack of maintenance.

Again, this site supports all three of the recommendations provided in the first survey report. It especially highlights the need for an advertising campaign to inform owners about the legal and practical need for annual maintenance of oil-burning equipment.

Discussion of Six Imminent Hazard Sites (continued)

4. [redacted] **Whitehorse:** This installation consisted of a 1999 combination water heater / space heater and an indoor aboveground tank of unknown age. Ten code infractions were identified of which seven were considered significant. Although the tank had four code infractions (two of which were significant), the imminent hazard related to the combo water heater.

Spillage of flue gases and moisture were found at the base tee and the combustion setup was both unsafe and inefficient. The #8 smoke reading indicated very poor combustion that had or would soon plug the heat exchanger and/or vent with soot. There was no air supply provided for the appliance and there was no barometric damper installed on the appliance.

This installation had not been installed or serviced by a licenced Oil Burner Mechanic. Indeed, annual maintenance had not been conducted on this appliance for some time.

The lack of maintenance and number of code infractions at this site supports all three of the recommendations provided in the first survey report. It especially highlights the need for an advertising campaign to inform owners about the legal and practical need for annual maintenance of oil-burning equipment.

5. [redacted] Only six code infractions were identified at this site but five were considered significant and the inspector shut-off the electrical supply to the appliance and advised the owner not to use it until it was serviced by a licenced technician. This installation had a 1998 space heater and 1998 indoor aboveground tank of the same age. Although the tank had three code infractions (two of which were significant), the imminent hazard related to the space heater.

After numerous attempts to start the appliance failed, the survey inspector noted “It seemed as though unburned fuel oil was accumulating in the fire box”. An attempt was made to conduct combustion tests when the appliance finally started but the inspector “recorded a very high CO [carbon monoxide] reading … in the room containing the heater”. As a result of this dangerous condition the inspector shut off the heater at the electrical disconnect switch and “instructed the home owner to have the unit replaced or properly repaired by a qualified technician”.

The owner indicated that the heater had not been installed or serviced by licenced Oil Burner Mechanic and that annual maintenance had not been conducted.

Again, this site supports all three of the recommendations provided in the first survey report. The advertising campaign to inform owners about the legal and practical need for annual maintenance of oil-burning equipment could also highlight the importance of employing qualified technicians.

Discussion of Six Imminent Hazard Sites (continued)

6. [redacted] This 1979 forced air furnace with a 2003 outdoor aboveground tank had six code infractions of which five related to the furnace and were all considered significant. The only infraction regarding the tank was the common one of no seismic restraint.

Like the second imminent hazard discussed above [redacted] this furnace was common vented with a wood stove that was not approved for use with an oil appliance. The inspector noted that the “flue is not sealed properly and [there are] signs of flue gas spillage”. The owner also complained about “periodically” smelling flue gases.

There was no combustion air supplied to the room with the oil furnace and wood stove. Given the massive volume of combustion air needed for both these appliances to operate properly, it is reasonable to assume that the flue gas odours were at least partially caused by negative building pressures resulting in pressure induced backdraft of the flue gases.

The furnace duct system installation also contributed to the flue gas spillage in that a return air opening was located near the wood stove to draw warm air (and probably wood smoke) from the area and distribute it around the house. Although this unsafe use of the furnace ductwork to distribute air heated by a wood stove is not an infraction specified in the B139 Code, it is not permitted by the National Building Code which the fuel oil code endorses as mandatory.

The combustion analysis conducted by the survey inspector showed that the appliance was operating inefficiently (71%) and unsafely (high CO reading). Given that flue gases spillage was noted by the owner and inspector, the high CO readings are a serious concern.

One of the most disturbing aspects of this case is the inspector notes that the appliance was serviced by a local heating contractor in February 2007 – two months before the survey inspection. The poor combustion setup and numerous infractions (no air supply, dirty air filter, as well as those discussed above) left by this contractor indicate either that the technician was not trained and qualified to conduct the service call or that the lack of legal requirements placed on technicians to effectively deal with imminent hazards contributed to the continuation of this hazard.

In either case, the three recommendations provided in the first survey report are further endorsed by an analysis of this imminent hazard.

Comparison of 1st and 2nd Survey inspection Results

The results of this second survey are very similar to those of the first survey conducted by NRG Resources in January 2007(see Appendix D for report).

The following table shows the high degree of similarities in both the conditions and results of both surveys. A few differences are also noted.

Issue	First Survey	Second Survey
Number of installations and appliances inspected/tested	55 sites with 63 appliances were inspected. Combustion tests were conducted on 60 of the appliances.	69 sites with 71 appliances were inspected. Combustion tests were conducted on 61 of the appliances.
	Comment: The size of the two surveys is much closer than the number of sites would indicate since there were more appliances per site and more combustion tests per site in the first survey.	
Age of appliances	Appliance age ranged from 1967 to 2006. Unknown age: 0 1960 to 1979: 32% 1980 to 1989: 2% 1990 to 1999: 30% 2000 to 2007: 36%	Appliance age ranged from 1972 to 2006. Unknown age: 20% 1960 to 1979: 10% 1980 to 1989: 10% 1990 to 1999: 32% 2000 to 2007: 28%
	Comment: It would be reasonable to add the number of "unknown age" appliances in the 2nd survey to the number of 1960-1979 appliances. As such, the age range of appliances in both surveys is essentially the same.	
Type of appliances	Furnaces: 70% Boilers: 11% Water heaters: 5% Combo systems: 3% Space heaters: 11%	Furnaces: 72% Boilers: 20% Water heaters: 1% Combo systems: 1% Space heaters: 6%
	Comment: There were more boilers and fewer water heaters, combo systems, and space heaters in the 2nd survey. The differences are not considered significant.	

Comparison of 1st and 2nd Survey inspection Results (continued)

Issue	First Survey	Second Survey
Number of tanks inspected	57 tanks were inspected.	69 tanks were inspected.
	Comment: The additional 12 tanks in the 2nd survey account for the higher number of infractions related to tanks in the 2nd survey. However, the number of such infractions per site was essentially the same as discussed later in this table.	
Age of tanks	Tank and supply line age ranged from 1967 to 2006. Unknown age: 0 1960 to 1979: 24% 1980 to 1989: 11% 1990 to 1999: 21% 2000 to 2007: 44%	Tank and supply line age ranged from 1976 to 2006. Unknown age: 22% 1960 to 1979: 1% 1980 to 1989: 1% 1990 to 1999: 32% 2000 to 2007: 43%
	Comment: It would be reasonable to add the number of "unknown age" tanks in the 2nd survey to the number of 1960-1979 appliances. As such, the number of pre-1980 tanks in both surveys is essentially the same. There is a slightly higher percentage of pre-1990 tanks in the 1st survey.	
Type of tanks	Indoor AST: 18% Outdoor AST: 59% UST: 23%	Indoor AST: 20% Outdoor AST: 70% UST: 10%
	Comment: The lower percentage of underground storage tanks (USTs) in the 2nd survey accounts for the reduction in emphasis of UST concerns voiced in the 2nd report. The differences are not considered significant.	
Total number of code infractions found	Code infractions: 319 Significant ones: 174 Average # per site: 5.8 Average # of significant concerns/site: 3.2	Code infractions: 366 Significant ones: 204 Average # per site: 5.3 Average # of significant concerns/site: 3
	Comment: The average number of infractions per site found by during the two surveys is essentially the same. The slightly higher percentage in the first survey may be due to the older age of equipment inspected.	

Comparison of 1st and 2nd Survey inspection Results (continued)

Issue	First Survey	Second Survey
Number of code infractions found related to tank and oil supply lines	157 or 49.2% of the total number of code infractions were related to the tank and supply lines. 73 (46%) of these 157 code infractions were considered to be "significant". The average number of code infractions per site related to the tank and supply lines was 2.9. The average number of significant infractions related to the tank and supply lines was 1.3 per site.	195 or 53.3% of the total number of code infractions were related to the tank and supply lines. 89 (46%) of these 195 code infractions were considered to be "significant". The average number of code infractions per site related to the tank and supply lines was 2.8. The average number of significant infractions related to the tank and supply lines was 1.3 per site.
	Comment: The average number of tank related infractions per site found by during the two surveys is essentially the same.	
Number of code infractions found related to appliances and venting systems	162 or 50.8% of the total number of code infractions were related to the tank and supply lines. 101 (58%) of these 162 code infractions were considered to be "significant". The average number of code infractions per site related to appliances and their venting systems was 3. The average number of significant infractions per site related to appliances and their venting systems was 1.8.	171 or 47% of the total number of code infractions were related to the tank and supply lines. 89 (46%) of these 195 code infractions were considered to be "significant". The average number of code infractions per site related to appliances and their venting systems was 3. The average number of significant infractions per site related to appliances and their venting systems was 1.3.
	Comment: The average number of appliance and vent system related infractions per site found by during the two surveys is exactly the same (3/site).	

Comparison of 1st and 2nd Survey inspection Results (continued)

Types of tank related infractions found	A comparison of the types of infractions identified in the two surveys found a high degree of similarity. However, the following minor differences were noted: 1. More cases of oil leakage were found during the 2nd survey (3 in 1st survey and 10 in 2nd survey). 2. More cases of tanks not being protected against corrosion were found during the 2nd survey (3 in the 1st survey and 9 in the 2nd survey). 3. The following types of tank related infractions were noted in the 1st but not in the 2nd report: ➢ Indications of water in UST ➢ Single wall underground lines used after 2000 ➢ UST is not buried deep enough ➢ Indications of an abandoned UST ➢ Tank vent pipe is too far away from fill pipe ➢ Underground lines under foundation ➢ Outlets on top of tank not plugged properly ➢ Tank within 5' of exit doorway ➢ Compression fittings on oil lines ➢ Tank within 20' of two propane tanks 4. The following types of tank related infractions were noted in the 2nd report but not in the 1st report: ➢ No valve at tank ➢ No whistle in indoor tank ➢ Tank clearances not met ➢ Filter housing not rated for >540°C ➢ Tank valve not approved for purpose. These differences in the types of tank infractions found during the two surveys are not considered significant.
Types of appliance and venting system related infractions found	A comparison of the types of infractions identified in the two surveys found a high degree of similarity. However, the following minor differences were noted: 1. More cases of flue gas leakage were found during the 2nd survey (2 in the 1st and 12 in the 2nd). 2. More problems with the installation of vent liner in a chimney or factory vent were found during the 2nd survey (4 in the 1st and 10 in the 2nd survey). 3. More cases of oversized vents were found during the 1st survey (22 in the 1st and 7 in the 2nd). 4. The following type of appliance related infractions was noted in the 1st but not in the 2nd report: ➢ Pressure relief on boiler improperly installed

Conclusion

The inspection survey of 69 residential sites in the Yukon with oil-burning equipment identified 366 infractions of the B139 Code of which 204 were considered to be significant concerns that either posed an imminent hazard (6 cases) or could reasonably be expected to develop into a problem in the future. The average number of code infractions per site was 5.3 and the average number of significant infractions was 3 per site.

The types of sites, equipment, and infractions reported in this second survey conducted by Carmon Whynot from Yukon Housing are very similar to those in the first survey conducted by NRG Resources in January 2007.

Both surveys identified eleven safety and efficiency issues, listed below in order of importance are:

1. **Lack of maintenance.** 79 of the 124 surveyed sites (i.e. 64%) were not in compliance with the B139 Section 14 requirements regarding annual maintenance. Very few of all the appliances inspected had been cleaned on a regular basis. In many cases, the appliances had never been cleaned or properly maintained. Lack of maintenance is universally recognized as the primary cause of fires, leaks, and other incidences for all fuel-fired appliances.

2. **No indication that the installers or service technicians are trained and qualified as licenced Oil Burner Mechanics.** 21 of the 124 sites inspected (17%) indicated that a licenced Oil Burner Mechanic installed or serviced the installation. This trend has also been evident in the five oil-related courses delivered by NRG Resources in the Yukon over the past two years. Of the 100+ active technicians who have attended these courses, less than 10 have met the minimum trade qualifications required to work on oil installations in the Yukon.

3. **Spillage of flue gases indoors due to improperly installed or improperly maintained appliances and their venting systems.** 14 cases of flue gases spilling indoors were found during the two surveys. This constitutes 11% of the 124 surveyed sites; all of the cases were significant and 6 were considered hazardous. Most of the cases involved positive vented appliances which require special venting material and are especially prone to failure if not strictly installed in accordance with the manufacturer's certified instructions and the B139 Code. There was a high level of improperly installed and maintained positive venting systems among the surveyed appliances. Spillage of carbon dioxide and carbon monoxide can cause severe health problems; heat spillage can cause fires.

4. **38% of the appliances were improperly set up for safe, efficient combustion.** 46 of the 121 combustion tests conducted during both surveys indicated that the appliances were operating inefficiently (i.e. <78% efficiency) and/or were not in compliance with the safety requirements for combustion established in the manufacturer's certified instructions and the B139 Code.

5. **Oversized, improperly installed, poorly maintained vent systems.** 71 of the 124 sites surveyed (57%) infractions related to their venting systems. 58 of these 71 cases (i.e. 82%) had significant code infractions and 11 of the 12 imminent hazard sites had venting infractions. Oversized, improperly installed, or poorly maintained vent systems may cause venting problems resulting in flue gas spillage and damage to the appliances. These problems are especially prevalent in cold climates. The most probable reason for oversized and improperly installed vent systems is the lack of trained technicians conducting installations.

6. **Clearance to combustible material is not maintained.** 31 of the 124 sites inspected (25%) had infractions related to clearance between combustible materials and the appliance or vent. Approximately half of these problems were related to installation infractions and the other half were caused by the owners storing material too close to the appliance or vent. In both cases, lack of knowledge is the most probably cause of this potentially dangerous infraction of the B139 Code requirements.

7. **Combustion air supply requirements are not met.** Infractions related to improper combustion air supply to appliances were found at 48 (36%) of the 124 sites inspected during the two surveys. 8 of the 48 cases were considered significant since they were in confined spaces and/or adversely affected the safe operation of the appliance(s) at the site. Properly sized, installed and maintained combustion air openings have been required since the 1976 B139 Code. They ensure the safety and efficiency of appliances that use air from inside the building. The high percentage of non-compliance can be contributed to lack of knowledge among technicians and owners about the importance of air supply openings as well as the lack of enforcement of code requirements.

8. **Aboveground tanks not installed or maintained properly to prevent internal and external corrosion.** Two related problems are covered by this item: 1/ 56 of the 106 aboveground tanks surveyed (53%) were not sloped toward the outlet as required by the current B139 Code; 2/ 15 of the 82 outdoor aboveground tanks surveyed (18%) showed signs of external corrosion. An improper slope has been proven to cause internal corrosion resulting in leakage. The lack of corrosion protection on outdoor tanks and the second problem may result in the outlet piping at the tank breaking resulting in leakage. Although lack of knowledge among technicians and owners is the most probable cause of these two related problems, the lack of legal requirements placed on oil suppliers to ensure that they are delivering to safe, compliant tank systems is the most effective solution.

9. **Lack of monitoring of underground tanks for leakage and corrosion.** None of the 20 underground storage tanks (UST) surveyed were regularly monitored for water accumulation or for cathodic protection. As discussed on page 4 of this report, the current edition of the B139 Code does not provide any requirements related to UST installation, maintenance, or removal. This is a significant problem since 20 of the 124 sites surveyed (16%) had USTs that would benefit from requirements given in previous Codes.

10. **Aboveground tanks not properly supported or secured to prevent toppling or damage - especially if a seismic event occurs - even though Whitehorse is listed as an earthquake zone.** Significant code infractions related to improper tank support and improper piping at the tank were found at 27 of the 106 aboveground tanks surveyed (25%). None of the 106 aboveground tanks surveyed were equipped with seismic restraints as required by the B139 Code and manufacturer's instructions.

11. **Appliances and tanks without rating plates indicating that they have not been tested and approved to recognized standards.** 31 of the 106 aboveground tanks surveyed (29%) and 4 of the 134 appliances surveyed (3%) did not have a rating plate. The approval of equipment to recognized standards is a primary safety requirement that is being undermined by this high percentage of unapproved equipment found in the survey sample (especially in regards to tanks). Unapproved equipment should be treated as sub-standard and unsafe unless proven otherwise.

A detailed discussion of possible solutions to the problems found during the two inspection surveys will be provided in a separate report in October 2007. However, it is worth noting that the three recommendations provided in the first report are confirmed and supported by the findings of the second inspection survey. The recommendations to improve the general safety and efficiency of oil burning equipment installations in the Yukon are offered again by way of conclusion.

A. An advertising campaign should be conducted to inform owners about the legal and practical need for annual maintenance of oil-burning equipment and the necessity of maintaining the proper clearances to combustibles around oil-burning equipment.

B. An Oil Burning Devices Act, Regulations, and enforcement agency should be developed and implemented to encourage and ensure that the oil heating industry complies with the B139 Code as well as the Yukon Apprentice Training Act and Regulations regarding training and licencing requirements for Oil Burner Mechanics.

C. A practical and effective method for training and licencing Oil Burner Mechanics in the Yukon should be developed and implemented.

I trust that this report meets with your approval. Please do not hesitate to contact me to discuss any of the issues raised in this report.

Yours Sincerely,

Rod Corea
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95 Napier St. W.
Thornbury, ON N0H 2P0
Ph: 519-599-3923
Email: rodcorea@nrgresources.ca

Notes:

Appendix A

Blank Inspection Report Forms

Inspection Checklist – Oil-Fired Appliances

OWNER/OPERATOR:
LOCATION: _____ **Tel. No.** _____

OWNER'S ADDRESS (if different from above) _____

Note: Inspection is limited to external observation of tanks and components in their operating position.

	1st Appliance	2nd Appliance
Type of Appliance **FAF** = Forced Air Furnace; **B** = Boiler; **WH** = Water heater; **SH** = Space Heater		
Manufacturer		
Model and Serial No.		
Date of Manufacture or Age in Years		
Firing Input	□ Btuh □ GPH	□ Btuh □ GPH
1. Does the owner or user indicate that the appliance is operating properly?	□ Yes □ No □ Unknown	□ Yes □ No □ Unknown
2. Does the owner or user indicate that the appliance was installed by a properly certified technician (for new installations) or has been annually maintained?	□ Yes □ No □ Unknown	□ Yes □ No □ Unknown
3. Is the appliance (including the burner) approved for its present use?	□ Yes □ No	□ Yes □ No
4. Is the installation free of indications of heat exchanger cracks, defects in the refractory, pot and/or heat shields?	□ Yes □ No	□ Yes □ No
5. Do all safety and operating controls required for this type of appliance appear to be installed properly and in good condition?	□ Yes □ No	□ Yes □ No
6. If the safety and operating controls were tested during this inspection, are they functioning properly?	□ Yes □ No □ N/A	□ Yes □ No □ N/A
7. Is the appliance installed with appropriate clearances from combustibles?	□ Yes □ No	□ Yes □ No
8. Are the combustion tests results conducted by a certified technician as part of the installation or annual maintenance readily available and acceptable?	□ Yes □ No	□ Yes □ No
9. If a combustion analysis is conducted, are the results acceptable? ▪ Flame characteristics: ▪ Overfire draft _____ ■ Breech draft _____ ▪ Smoke reading _____ ■ Net Stack Temp _____ ▪ CO_2 _____■ O_2 _____■ CO _____ ■ Efficiency _____	□ Yes □ No □ N/A	□ Yes □ No □ N/A
10. Is the appliance venting system approved for use with the appliance?	□Yes □ No	□ Yes □ No
11. Is the venting system properly sized and installed (including slope and clearances)?	□ Yes □ No	□ Yes □ No
12. Is the venting system free of defects, debris or corrosion?	□Yes □ No	□ Yes □ No
13. For masonry chimneys, is the chimney properly lined and fitted with proper flashing, cap and clean-out or base tee?	□ Yes □ No □ N/A	□ Yes □ No
14. For factory-built vent systems, is the vent properly installed and fitted with proper flashing, cap, and base tee?	□ Yes □ No □ N/A	□ Yes □ No □ N/A
15. For sidewall vent systems, is the system installed according to the Fuel Oil Code and the manufacturer's instructions?	□ Yes □ No □ N/A	□ Yes □ No □ N/A
16. Are properly sized and located combustion and ventilation air openings installed?	□ Yes □ No □ N/A	□ Yes □ No □ N/A
17. If required, is the barometric damper properly installed?	□ Yes □ No □ N/A	□ Yes □ No □ N/A
Comments: Any "No" answers must be explained below along with the action taken to correct any problem(s).		
Inspector's/Technician's printed name (below) and signature: **Date:** DD / MM / YYYY		

Inspection Checklist
Aboveground Tank and Supply Systems

OWNER/OPERATOR: _____

LOCATION: _____ **Tel. No.** _____

OWNER'S ADDRESS (if different from above) _____

Note: Inspection is limited to external observation of tanks and components in their operating position.

	1st.TANK ☐ Indoor ☐ Outdoor	2nd.TANK ☐ Indoor ☐ Outdoor
Type of Tank (e.g. ULC-S602) and Size		
Manufacturer		
Date of Manufacture or Age in Years		
Serial No.		
1. Does the tank appear to be in good condition and installed in accordance with the Fuel Oil Code, the certification document, and the manufacturer's instructions?	☐ Yes ☐ No	☐ Yes ☐ No
2. Is the tank approved for its present use?	☐ Yes ☐ No	☐ Yes ☐ No
3. Is the tank properly protected from external physical damage?	☐ Yes ☐ No	☐ Yes ☐ No
4. For outside tanks, are the proper clearances from buildings, openings, and property lines maintained? If required, is the tank protected with proper secondary containment?	☐ Yes ☐ No ☐ N/A	☐ Yes ☐ No ☐ N/A
5. For inside tanks, are the capacity limitations and location in accordance with the Fuel Oil Code?	☐ Yes ☐ No ☐ N/A	☐ Yes ☐ No ☐ N/A
6. Is the tank properly supported on a firm base? Is the tank support system in good condition, non-combustible and stable?	☐ Yes ☐ No	☐ Yes ☐ No
7. Does the tank have an acceptable form of seismic constraint and, if appropriate, flood constraint?	☐ Yes ☐ No	☐ Yes ☐ No
8. Are the tank vent and fill pipes of steel or galvanized construction and properly installed and terminated with proper caps?	☐ Yes ☐ No	☐ Yes ☐ No
9. Is the inside tank equipped with a proper gauge and overfill protection device (whistle) or, if outdoors, equipped with a means of gauging the tank level?	☐ Yes ☐ No	☐ Yes ☐ No
10. If two tanks are joined, are they installed on a common slab and, if bottom connected, installed in accordance with the Fuel Oil Code?	☐ Yes ☐ No ☐ N/A	☐ Yes ☐ No ☐ N/A
11. Is an approved shut-off valve installed as close to the tank as possible and at other locations as required to avoid spillage during servicing?	☐ Yes ☐ No	☐ Yes ☐ No
12. Is an approved filter installed indoors (if feasible)?	☐ Yes ☐ No	☐ Yes ☐ No
13. Are the tank and supply systems free of leaks or any signs of weepage?	☐ Yes ☐ No	☐ Yes ☐ No
14. Are the tank and piping systems protected to prevent external corrosion as appropriate and to prevent internal corrosion of the tank by being sloped toward the tank outlet?	☐ Yes ☐ No	☐ Yes ☐ No
15. Are burner supply/return lines installed in accordance with the Fuel Oil Code?	☐ Yes ☐ No	☐ Yes ☐ No
16. If any piping/tubing is installed in concrete walls or floors, is it installed in accordance with the Code? If underground piping was installed after 2000 is it double-walled?	☐ Yes ☐ No ☐ N/A	☐ Yes ☐ No ☐ N/A
17. Are proper joints and connections employed for the burner supply/return lines?	☐ Yes ☐ No	☐ Yes ☐ No
18. Do all external parts of the fuel system have a temperature rating above 538°C (1000°F) or, if not, are the non-complying parts properly installed in accordance with the Code?	☐ Yes ☐ No	☐ Yes ☐ No

Comments: Any "No" answers must be explained below along with the action taken to correct any problem(s).

Inspector's/Technician's printed name (below) and signature: **Date:** DD / MM / YYYY

Inspection Checklist
Underground Tank and Supply Systems

OWNER/OPERATOR: _____

LOCATION:_____ **Tel. No.** _____

OWNER'S ADDRESS (if different from above) _____

Note: Inspection is limited to external observation of tanks and components in their operating position.

NOTE: Indicate the source and reliability of information given in first 6 un-numbered	**1st.TANK**	**2nd.TANK**
Type of Tank (e.g. ULC-S603) and Reported Size **Source: Owner**	□ Unknown	□ Unknown
Manufacturer and Date of Manufacture **Source: Owner**	□ Unknown	□ Unknown
Date of Installation or Age in Years **Source: Owner**	□ Unknown	□ Unknown
Tank Construction Material and Type **ST** = Steel **FRP** = Fiberglass **SW** = Single Wall **DW** = Double Wall **Source: Owner**	□ Unknown	□ Unknown
Underground Piping Construction Material and Type **CT** = Copper Tubing **ST** = Steel **FRP** = Fiberglass **PL** = Plastic **SW** = Single Wall **DW** = Double Wall		□ Unknown
Was the underground tank and piping installed by a qualified contractor?	□ Yes □ No □ Unknown	□ Yes □ No □ Unknown
1. Is the apparent location of the UST in compliance with the Fuel Oil Code in effect at the time of installation?	□ Yes □ No □ Unknown	□ Yes □ No □ Unknown
2. If applicable, does the owner have acceptable corrosion test records for underground steel tanks and piping?	□ Yes □ No □ N/A	□ Yes □ No □ Unknown
3. Are the tank vent and fill pipes constructed of the proper material and properly installed and terminated with proper termination caps or hoods?	□ Yes □ No	□ Yes □ No
4. Is the tank capable of being manually dipped?	□ Yes □ No	□ Yes □ No
5. If a water-paste dip test is possible, is the tank free of water contamination?	□ Yes □ No □ N/A	□ Yes □ No □ N/A
6. If applicable, is the tank equipped with a proper spill box & overfill prevention device?	□ Yes □ No □ N/A	□ Yes □ No □ N/A
7. If applicable, is the tank vent and fill equipment protected from vehicle impact?	□ Yes □ No □ N/A	□ Yes □ No
8. Do the underground supply/ return lines from the tank to the building appear to be installed in accordance with the Fuel Oil Code?	□ Yes □ No	□ Yes □ No
9. Do the outside supply/ return lines enter/ exit the ground and building in accordance with the Fuel Oil Code?	□ Yes □ No	□ Yes □ No
10. Is an approved shut-off valve installed at locations as required to avoid spillage during servicing?	□ Yes □ No	□ Yes □ No
11. Is an approved filter installed indoors (if feasible)?	□ Yes □ No	□ Yes □ No
12. Are the indoor supply/ return lines installed in accordance with the Fuel Oil Code?	□ Yes □ No	□ Yes □ No
13. If any piping or tubing is installed in concrete walls or floors, is it installed in accordance with the Fuel Oil Code?	□ Yes □ No □ N/A	□ Yes □ No □ N/A
14. Are proper joints and connections employed for the burner supply/ return lines?	□ Yes □ No	□ Yes □ No
15. Do all external parts of the fuel system have a temperature rating > 538^{o}C (1000^{o}F) or, if not, are non-complying parts properly installed in accordance with the Code?	□ Yes □ No	□ Yes □ No

Comments: Any "No" answers must be explained below along with the action taken to correct any problem(s).

Inspector's/Technician's printed name (below) and signature: **Date:** DD / MM / YYYY

NRG Resources Inc. has over 30 years of experience in the heating and training industry. It is a federally incorporated company headed by **Rod Corea**.

Rod is a certified Oil Burner Technician 1 in the Province of Ontario with 30 years experience in the oil and gas industry – 12 years of which he was employed at the *Technical Standards and Safety Authority* (TSSA) as a Fuels Safety Inspector, Training Program Developer, and Training Consultant. He has taught technical training courses to over 4,000 heating technicians as an instructor for various colleges and as the owner of *NRG*'s predecessor company - *Fuel Safe Training*.

Rod has developed or co-developed the following training courses:

- *The Fuel Safe Manual – A Handbook for the Fuels Safety Workshop*
- *Oil Burner Technician Manuals* (for the Oil Institute of Learning)
- *Gas Technician Update Workshop Handbook* (for TSSA)
- *Oil Burner Technician Update Workshop Handbook* (for TSSA)
- *Industrial Maintenance Technician Manuals* (for various manufacturing industries)
- *Oil Pipe Fitter Manual* (for the Ontario Pipe Trades Council)
- *Gas Technician 1 Manual*
- *Practical Guide to Safe Fuel oil Installations*, *Installation Codes for Furnaces and Boilers*, *Combustion Tests for Oil-Burning Equipment, and Installation of Oil Burning Equipment* (4 manuals employed for the delivery of 4 courses for Yukon Housing and Energy Solutions)

NRG Resources Inc. has proven its ability to develop and deliver the highest quality of consultation and training services. The field and regulatory experience, skills, and contacts upon which *NRG Resources* is founded make it uniquely qualified to complete the inspection survey of oil-burning equipment in the Yukon.

NRG
Resources Inc.