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GAS FIRED APPLIANCES GAS SAFETY REGULATIONS IN ALBERTA & SASKATCHEWAN

PETROLEUM INDUSTRY BRIEF
03 October, 2003

This brief is intended to summarize our observations and findings from our recent discussions and dealings with various government and industry participants regarding the introduction of gas safety code regulations to the Alberta and Saskatchewan Petroleum Industry. It is also based on over 20 years of our experience with industrial combustion and control systems and involvement in numerous similar discussions throughout North America. The current situation in Alberta is not unique from the point of view of the issues but it is special because of the shear size of the petroleum industry, the number of potentially applicable installations, issues of remote access and feasibility of implementation without available electrical utilities.

The government proposed enforcement process of the gas safety regulation is encountering strong opposition and many objections from the petroleum industry. The discussion seems to be stuck at two opposing views and no significant progress in being made. At the same time there does not seem to be any significant infrastructure buildup on the part of the government and certification bodies in support of the new inspection requirements. As a result the process simply does not work and therefore its intent is failing.

It is clear that the current directives need to be re-evaluated using input from the industry through CAPP (Canadian Association of Petroleum Producers) to bring about the intended results, and to turn a possible confrontation into cooperation.
A logical progression could be made by changing the emphasis of this process from enforcement to awareness and education campaign.

For the purpose of addressing specific Act, Code and other related issues this brief is presented in form of Questions and Answers.

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QUESTION: 1. WHAT IS THE REQUIREMENT?

ANSWER: The Alberta Municipal Affairs Safety Section issued a STANDATA Gas Safety Bulletin G-02-01a-IB (16090-G01-01-2002) dated June 2002 entitled: Uncertified Appliances and Equipment Requires Special Inspection and Approval".
The bulletin stipulates that:

"In Alberta under Safety Codes Act, the inspection and approval of uncertified gas appliances and equipment is to be conducted by nationally recognized Certification Bodies accredited by the Standards Council of Canada. A special inspection is not intended to be used as a means to accept appliances and equipment when certified products of similar type are available.
When certified products are not available, a special inspection and approval must be conducted by one of the following Certification Bodies currently operating in Alberta."
Here the bulletin lists three Certification Bodies:

CSA International (CSA), Intertek Testing Services NA Ltd. (cETL or WH), and Underwriters Laboratories of Canada (ULC).

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QUESTION: 2. WHAT ARE THE IMPLICATIONS OF THIS BULLETIN ON THE INDUSTRY?

ANSWER: Although it is not clear at a first glance what this bulletin encompasses, an in-depth look at the applicable legislation and referenced codes, standards and regulations suggests it has wide spread impact on the petroleum industry. Of particular concern is the sharp contrast with the current industry standards and practices and the cost of implementation of these new regulations.

Here are only some of the implications:

a) According to the Alberta Safety Codes Act it is considered illegal to build, sell, install, and start a gas fired appliance which is not "certified". It is also illegal to modify an existing appliance without re-certification. There is a stipulation in the Act that not complying with these rules as first time offence carries a maximum penalty of $15,000 plus $1,000 for each day during which the offence continues and/or a 6-months jail term, the second time and subsequent offences carry a maximum penalty of $30,000 plus $2,000 for each day during which the offence continues and/or and a 12-month jail term.

b) The certification has to be obtained for the entire appliance and not only for some of its components. For example: installing a "certified" valve, "fuel train" or burner management system, etc. on a new or existing appliance does not make the whole appliance automatically certified.

c) The approval process has to be done for each specific appliance or a specific model of an appliance according to the requirements of one of the three specified "Certification Bodies".

d) The certification body may at its discretion accept or reject a specific appliance (or its part) certification under a premise that it should be replaced with a similar product which is already certified.

e) The certification process is not defined in regulations except that it is left to the discretion of "Certification Bodies". The criteria and scope of such certification are at this point open.

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QUESTION: 3. WHAT IS GAS?

ANSWER: In the past, codes were written individually for each fuel such as natural gas (CAN/CGA-B149.1-M86) or propane (CAN/CGA-B149.2-M86).

The current code defines two types of gas: atmosphere gas and reaction gas.

The **atmosphere gas** definition applies *"equally to and including any of the following gases, or mixtures of them: natural gas, manufactured gas, propane, propane air, propylene, butane (normal butane and isobutene), and butylene"*.

The **reaction gas** is defined as*: "all of the gases that, after reacting with air in an endothermic generator by the addition of heat, become the special atmosphere gas."*

The new proposed amendments to the code define gas as: *"natural gas, manufactured gas, liquefied petroleum gas, LP gas-air mixture, mixed gas, field gas"* or any mixture or the above.

With a definition of *"gas"* being expanded to include components of the *"field gas",* plus previous definitions of *"atmosphere gas"* and *"reaction gas"* it is not clear if any other gases (such as H2S or CO) are or will be at some point subject to the regulations.

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QUESTION: 4. WHAT IS AN APPLIANCE?

ANSWER: Current definition of appliance: *"a device to convert gas into energy that includes any component, control wiring, piping, or tubing required to be a part of the device*".

Component is defined as*: "any essential part of an appliance or equipment"*

The common reaction from readers being introduced to the code is that the industrial processes do not use "appliances" but rather engineered fit-for-purpose systems. The word *"appliance"* is here often equated to mass-produced house furnaces, water heaters, gas fireplaces or commercial space heaters.
This is not the intent of the code, which uses the word *"appliance"* since 1958 in a very broad context as defined above.

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QUESTION: 5. WHAT IS EXCLUDED FROM REGULATIONS?

ANSWER: The current regulations exclude the following from the code:

"*a) installations in marine pipeline terminals*
b) gas where used as a feedstock in petroleum refineries and chemical plants
c) gas designated for storage and handling, or both at liquefied petroleum gas bulk plants
d) gas where used for natural gas for vehicles
e) a new appliance for which there is an approved standard
f) a manually operated appliance with an input not exceeding 20,000 BTU/hr used for industrial application
g) other fuels used in combination with gas"

These exclusions are discussed further in the following paragraphs.

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QUESTION: 6. CAN THE EXCLUSION BE BASED ON THE LOCATION OF THE APPLIANCE ?

ANSWER: A common tendency in the industry is to look at the code exclusions from the point of view of **where** the *"appliance"* is installed. The wording of the code seems to indicate that the refinery, marine pipeline terminals, LNG facilities, etc. are excluded from the code. This also is not the intent of the code.

We discussed this definition with CSA and here is the way we understand the concept:

a) regulations apply to any industry and to any system or its part which uses gas through a combustion process with intent to produce energy.

b) regulations do not apply to any system or its part in which gas is used as a feedstock to a reaction with intent to convert it to some other chemical compound.

It is common in the petroleum industry to have two (or more) gases entering a system, one of which is used as a fuel to, for example, heat the other gas which is then converted into some other compound. In such case, according to CSA, the heating portion of the appliance is subject to the approval and the processing part is not.

A good example of this concept is a *reaction furnace* in a Claus sulfur recovery process. For those who do not know the function of this "appliance", let us briefly explain. The sulfur plant process gas of H2S, a component in acid gases is converted into elemental molten sulfur. This part of the operation is exempt from these code changes as the H2S provides the typical reaction. Associated with this appliance there is generally a secondary fuel gas train that provides a pilot flame and often a larger main burner to warm up the furnace at start-up. Secondly, the fuel train is also required to provide a stochiometric fuel gas burn prior to shutdown of the sulfur train to sweep the sulfur train free of sulfur for maintenance entry. This is a cycle typically repeated every 2-3 years for maintenance. During operational periods while running on the H2S reaction process a shutdown of the furnace may occur requiring a fuel gas light-off of the acid gases to re-start the process. Typically fuel gas is only used for 2-3 days to start the furnace and 2-3 days to shutdown for maintenance. For the remainder of operating period the furnace runs on hydrogen sulphide in the acid gas.

The way that CSA looks at this application is that the fuel gas is used to produce

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thermal energy, hence all fuel gas trains, BMS etc, must be approved. On the other hand the acid gas is a feed stock to the furnace as it is being converted to molten sulfur, hence the approval requirement does not apply to it. It does not appear to matter that the furnace may only run on fuel gas perhaps 6 days in each 2-3 year cycle versus 1077 days on acid gas. In a recent upgrade project of a reaction furnace at one of Alberta's gas processing plants this concept was discussed and accepted by CSA.

To summarize, it is our understanding, that any indirect or direct contact boiler, tank heater, air heater, immersion heater, or furnace or any other device which uses gas to produce energy (thermal) is subject to the regulations and approval requirements with regards to its fuel gas (energy producing) components, regardless if it is used in a refinery, gas plant, industrial or commercial plant or in the field.

Alberta's Municipal Affairs office confirmed that in Alberta, no industry will be exempted from these regulations. Other provincial governments seem to be waiting for the outcome of the current Alberta's and Saskatchewan's initiative.

The wording related to the exclusions from the code, jurisdiction issues and enforcement should be further discussed and amended to avoid confusion.

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QUESTION: 7. ARE OTHER FUELS EXCLUDED FROM THE CODE?

ANSWER: It may seem that item g) excludes other fuels from the regulations, however, the code includes another stipulation:
"*When another fuel is used in the installation and in combination with gas, the requirements for safe operation of that fuel should be acceptable to the authority having jurisdiction*".

Although this paragraph was most likely put in the code originally to address fuel oil/gas burners, it now leaves wide room for interpretation of applicability of code regulations to any gaseous, liquid and solid combustibles common in the industry. From an engineer's perspective this statement requires that due-diligence be exercised to ensure that the *"other fuels"* operation complies with other (unspecified at this point) code, which makes indirectly these *"other fuels"* requirements again part of the gas code.

Taking under consideration a large number of combustible compounds handled by the petroleum industry it is not clear who the *"authority having jurisdiction*" is for *"other fuels",* what exactly these *"other fuels"* include and what other codes might be applicable.

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QUESTION: 8. WHO IS "AN AUTHORITY HAVING JURISDICTION"?

ANSWER: In Canada gas safety regulations fall into provincial jurisdictions and vary from province to province. In some provinces like BC or Saskatchewan this function is performed by a government operated gas safety branch and gas inspectors are government employees. In other provinces like Alberta or Ontario the inspection services are performed by accredited organizations, such as municipalities or inspection agencies.

The *"authority having jurisdiction"* is defined in the Code as: *"the governmental body responsible for the enforcement of any part of this Code or the official or agency designated by that body to exercise such a function."*

There is a large demand for inspection services of gas fired household and commercial appliances. To fulfill this need, Alberta's Safety Codes Council identified two levels of expertise applicable to gas installations:
- Certified Gasfitters (Second Class up to 400,000 BTU/hr installations and First Class for unlimited rating installations)
- Level 1 Gas Safety Codes Officer – with a *"power to inspect/monitor all natural gas/propane installations, except those installations dealing with motor vehicle carburation"*

To become a Level 1 Gas Safety Codes Officer an individual must have an Alberta Journeyman certification as a First Class Gasfitter and five years of experience as a Journeyman or equivalent qualifications, plus pass six courses offered by the Safety Codes Council. Then to be "empowered" i.e. able to perform inspection/monitoring duties such Level 1 Gas Safety Officer must be employed by an accredited organization such as a municipality or an inspection agency providing inspection services on behalf of the province for non-accredited municipalities. In other words the responsibility for the gas safety enforcement has been given by the Alberta's provincial government to municipalities which may decide to become accredited to do gas inspection services themselves, or leave it to private accredited inspection companies.

This gas appliance installation / inspection infrastructure and a corresponding system of permit, fees, and reporting methods is now in place in Alberta. Municipal Affairs website http://www3.gov.ab.ca/ma/ss/Permit.cfm lists over 350 municipalities which are, either themselves or through one or more of over 50 registered inspections agencies, providing gas installation inspection services.

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It is also the same (or similar) infrastructure of certified gasfitters and Level 1 Gas Safety Officers the provincial government seems to be considering for supervision of safety of gas installations in the petroleum industry.

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QUESTION: 9. CAN CERTIFIED GASFITTERS AND GAS SAFETY CODE OFFICERS BE USED FOR GAS APPLIANCE INSTALLATIONS IN THE PETROLEUM INDUSTRY?

There are a number of problems with this idea which are being pointed out by various parties:

a) Unlike other industrial plants (including petroleum plants in BC), petroleum plants in Alberta do not seem to employ certified gasfitters. Piping work is usually done by pipe fitters, qualified welders and instrumentation technicians.

b) Petroleum industry deals with high pressure (in excess of 1000 PSIG) gases of various compositions. Gasfitters who are typically trained on low pressure natural gas and propane installations do not have training or experience to deal with this type of gases.

c) Many of the gases are poisonous and handling them requires special training and qualifications. Again gasfitters are typically not trained in this respect.

d) Petroleum industry uses own standards which are considered more stringent and demanding than those used in other industries. An average gasfitter would not be familiar with petroleum industry standards.

e) Petroleum industry piping standards are not consistent between companies and sometimes individual plants. A detailed knowledge of each plant standard is required for a gasfitter to work in a specific plant.

f) Many petroleum plants use all welded piping for gas. Since gasfitters do not have typically welding qualifications, they could not complete actual connections to the appliances as suggested by the code. Threaded piping is reserved mostly for instrumentation and performed by instrumentation technicians.

g) compared to many high risk, high pressure sour gas connections which are part of petroleum plant's every-day operations, typical low pressure sweet gas connections to gas fired appliances are considered by the petroleum industry to be low risk and not worth any special treatment as required by the gas code. It would not be practical and it would be prohibitively expensive in the eyes of any petroleum plant operation to go through an effort of bringing a gasfitting contractor to site just to supervise a gas connection to an appliance, especially if this gasfitting contractor would not be qualified according to petroleum standards

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to perform this work himself anyway.

h) safety training requirements are individually tailored to each plant include courses such as WHMIS, H2S-Alive, and plant specific courses. Outside contractors including gasfitters would be required to pass these courses at their own expense before they were even allowed on site.

i) safety requirements of petroleum plants include also special personal protection equipment and training in its use. Gasfitters do not have such equipment or training.

i) most of the gas fired appliances used in the petroleum industry are specialized engineered designs, startup and operation of which is not known to average gasfitter. Even with more common appliances, their startup would have to be performed by the plant operators due to a possible impact on the other parts of the process.

j) Some plants indicate that the idea of bringing external contractor gasfitters may create conflict with the existing collective agreements and with other unionized trades.

k) The location of some plants, and field equipment is so remote that they can be only accessed by ATV's or helicopters. The cost and logistics of bringing and sustaining gasfitting contractors and gas safety officers in such locations is considered prohibitive.

It is clear, that there is a significant mismatch between the definitions of gas expertise from the point of view of the gas safety code and existing infrastructure of certified gasfitters and gas safety code officers versus the definitions of gas expertise used by the petroleum industry.

It is also difficult to imagine that outside contracting of such services with thousands of installations in existence throughout the most remote areas could be done in a cost effective manner.

Until the above concerns are addressed and resolved there will be a strong opposition in the petroleum industry to any cooperation with the local gas safety authorities or gasfitting trades.

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QUESTION: 10. WHAT DOES IT MEAN CERTIFIED?

ANSWER: The above discussion regarding the suitability of the existing infrastructure of gasfitting contractors and gas safety officers for work with the gas appliances, is based on the premise that their expertise would be used solely for the implementation of the prescribed installation standards and practices for appliances, which are already certified.

The reality of the petroleum industry operations is that almost none of the thousands of appliances (existing or new) are certified. According to the current law the gasfitters and gas safety officers are neither allowed to work on such uncertified appliances, nor have an authority, qualifications or experience to certify such appliances.

Lets look closer at the definition of appliance certification:
"Certified – (with respect to any appliance, component, accessory, or equipment) investigated and identified by a designated testing organization as conforming to recognized standards, requirements, or accepted test reports."

The above definition sets a general framework for the certification process of appliances by designated testing organizations (also called Certification Bodies). It assumes that these testing organizations have required technical expertise, industry experience and process knowledge, testing equipment and infrastructure to perform the prescribed investigations. In addition, it assumes that there are recognized standards, requirements and accepted test reports applicable to a specific type of equipment on which the above investigation could be based.

The current reality is that in many cases both assumptions are simply incorrect in the petroleum industry environment.

Going back to the STANDATA Gas Safety Bulletin G-02-01a-IB, the certification of uncertified appliances must be done by one of three Certification Bodies: CSA International (CSA), Intertek Testing Services NA Ltd. (cETL or WH), and Underwriters Laboratories of Canada (ULC).

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QUESTION: 11. WHERE DO RECOGNIZED GAS SAFETY STANDARDS COME FROM?

ANSWER: The majority of new gas safety regulations and all associated discussions related to their interpretation refer us to a variety of publications by the Canadian Standards Associations. The mandate of this organization is summarized on their web page http://www.csa.ca/standards/gas_equipment/Default.asp?language=English under *"Gas Equipment"* as follows:

*"**Gas equipment standards** provide businesses with a practical framework for developing efficient products and services, and help to ensure that consumers enjoy the benefits of this safe, sustainable, and cleaner-burning fuel. CSA's suite of codes and standards address the safety and performance of gas equipment from the gas-fired appliances in homes, and propane-fuelled taxis on city streets, to the gas-fired equipment used by campers.*

*CSA is North America's premier provider of installation codes and product safety and performance standards for natural-gas and propane-fired equipment, and is **the only standards-development organization that provides both electrical and gas standards for Canada and the U.S.** Our standards include country-specific codes, such as the Canadian B149 series, and many bi-national standards that are suitable for use in Canada and the U.S.*

The current edition of CAN/CSA-6.19 is a North American pacesetter in performance reliability testing for carbon monoxide detectors. CSA is also the international leader in the development of standards for fuel cells.

*CSA offers **national training programs** for all aspects of gas fitting, including equipment installation, maintenance and servicing. We also offer documents and training to support gas industry professionals in understanding and implementing the various codes.*"

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QUESTION: 12. WHAT TYPE OF GAS APPLIANCES DO CSA STANDARDS COVER?

ANSWER: In their publication catalogue CSA includes the following list of 230 standards related to "Gas Equipment":

- *accessories (46)*
- *domestic and commercial water heaters and boilers (10)*
- *food processing and food refrigeration (12)*
- *gas-fired domestic and commercial heating equipment and air conditioning (43)*
- *gas technician training materials (43)*
- *hose, couplings and assemblies (3)*
- *incineration (2)*
- *large input commercial and industrial equipment (over 400,000 BTU/hr) (11)*
- *laundry equipment (4)*
- *manual valves (3)*
- *natural gas and propane installation codes (6)*
- *natural gas and propane vehicle fuel systems and industrial engines (17)*
- *other installation codes (7)*
- *performance test methods (7)*
- *portable-type camping equipment (10)*
- *special code publications (6)*

A cursory look at this list shows that the majority (93%) of these codes and standards are designed for small mass produced domestic or commercial type appliances and are not applicable to the petroleum industry operations.

A more detailed look at the standards yields the following list of 15 standards which refer to the industrial gas combustion equipment (in excess of 400,000 BTU/hr):

- CAN1-3.1-77(R2001) Industrial and Commercial Gas-Fired Package Boilers - 400,000 to 10.0 MMBTU/hr
- CGA 3.2-1976(R1999) Industrial and Commercial Gas-Fired Package Furnaces - 400,000 to 10.0 MMBTU/hr
- CGA-3.4-1973(R1999) Industrial and Commercial Gas-Fired Conversion Burners - 400,000 to 50.0 MMBTU/hr
- ANSI Z83.4-1999/CSA3.7-M99 Non-Recirculating Direct Gas-Fired Industrial Air Heaters (Over 400,000 BTU/hr)
- ANSI Z83.18-2000 Recirculating Direct Gas-Fired Industrial Air Heaters (Over 400,000 BTU/hr)
- CGA 3.11-M88(R1999) Lever Operated Pressure Lubricated Plug Type Gas Shut-Off Valves
- CGA 3.16-M88(R1999) Lever Operated Non-Lubricated Gas Shut-Off Valves
- ANSI Z21.18/CSA 6.3 Gas Appliance Pressure Regulators
- ANSI Z21.21/CSA 6.5 Automatic Valves for Gas Appliances
- CAN/CSA-B149.1-00 Natural Gas and Propane Installation Code
- CAN/CGA-B149.1-M91 Natural Gas Installation Code
- CAN/CSA-B149.2-00 Propane Storage and Handling Code
- CAN/CGA-B149.2-M91 Propane Installation Code

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- CAN/CGA-B105-M93(R1996) Code for Digester Gas and Landfill Installations
- CAN/CSA-B149.3-00 Code for the Field Approval of Fuel-Related Components on Appliances and Equipment

In the above group there are only four codes dedicated to a specific appliance type: packaged boilers up to 10 MM BTU/hr, packaged furnaces up to 10 MM BTU/hr and direct gas fired (recirculating and non-recirculating) industrial air heaters. There are five codes related to specific components such as burners, valves, and regulators, and five codes related to installation practices.

There is finally one "catch-all" B149.3 Code for the field approval of fuel-related components and equipment, which are otherwise non-certified.

There are no standards at present designed specifically for the petroleum industry type of appliances and since many of these appliances cannot be classified as a packaged boiler or furnace with less than 10 MM BTU/hr rating or a direct-fired air heater, they fall automatically under the scope of B149.3 code.

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QUESTION: 13. IS B149.3 THE ONLY CODE APPLICABLE?

ANSWER: It may seem that the B149.3 is the only code, which has to be taken under consideration in the approval of appliances, and most industry participants are indeed focusing on this particular document.

The scope of the B149.3 code is described as:
"This Code contains the requirements, which include valve train diagrams, for fuel-related components and accessories and their assembly on an appliance utilizing gas, downstream of the manual shut-off valve specified in Clause 5.18.2 of CSA Standard B149.1."

Within the text of the B149.3 code there are references to the following other codes:
- CAN/CSA-B149.1-00 Natural Gas and Propane Installation Code
- CAN/CSA-B149.2-00 Propane Storage and Handling Code
- CAN/CSA-C22.1-1998 Canadian Electrical Code, Part I
- ANSI Z21.21/CSA 6.5-M95 Automatic Valves for Gas Appliances
- CGA 3.9-M94 Automatic Valves for Gas Appliances

The problem with applying the B149.3 code in the petroleum industry is that the code was originally developed for natural gas and propane fired boilers and simply does not (and can not) cover many of the special cases encountered with petroleum industry type appliances. So the only way to apply it to these special appliances and process requirements, is to use engineering judgment, experience and common sense approach (with all three components being present). This work can only be done by trained and experienced professionals who understand the intent of the code, the inner workings of each specific appliance and the process itself.

For less qualified individuals, it is natural to read the code and after not finding the exact match for the application on hand to arrive at a conclusion: "this code is not applicable to what I am doing….".

But then, this misses the whole point of the code which is the safety aspect of gas installations and some level of standardization and consistency of achieving it throughout various industrial and commercial gas applications.

In other words applying the code may not be an easy solution but not applying it is not a solution either.

To address this perception government, CSA and other certifying bodies are

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performing a difficult function addressing code supplements, additions, amendments, clarifications, variances and references to other codes in order to cover many possible angles of new known applications and yet to leave the code open to as many uncertified future applications as possible. This process seems to be self-perpetuating and leads to ever increasing complexity of these regulations to a point that it is difficult for a regular industry participant to effectively follow and apply them. Aside from missing the intent the functionality and economic feasibility quickly comes into question.

In a recent appliance approval evaluation received from CSA we have found references to other codes which are not referenced in the B149.3 code itself such as:

- NFPA 86C-1999 Standard for Industrial Furnaces Using Special Processing Atmosphere
- NFPA 86D-1999 Standard for Industrial Furnaces Using Vacuum as an Atmosphere
- CSA Standard C22-2 No. 0.4-M1982 – General Requirements – Canadian Electrical Code, Part II
- CSA Sts C22.2 No. 0.4-M1982 – Bonding and Grounding of Electrical Equipment
- CSA Std C22-2 No. 3-M1988 Electrical Features of Fuel Burning Equipment

Current work on the Technical Information Letter (TIL) No. TP186 which will be apparently done in the consultation with the industry, is also an example of such attempt at broadening the scope of B149.3 to cover the special requirements of the petroleum industry environment. The purpose of this TIL is described as: *"to provide interim certification requirements for fuel burning equipment for use in industrial gas and oil-field applications"*.

In summary, it is our experience that the B149.3 gas code with its ever growing scope and complexity is, and will be for a long time, a work-in-progress and it should be treated as such.

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QUESTION: 14. IS B149.3 A NEW CODE?

ANSWER: No, the B149 code is over 45 years old.
The gas code history goes back to 1958 when the Canadian Standards Association published the first edition of the CSA standard B149, Installation Standard for Gas Burning, Appliances and Equipment.

It was superseded by later editions in 1962 and 1966. Following the 1966 publication, the decision was made to split the code into two parts: B149.1 - natural gas installation, and B149.2 for propane installation. The B149.2 was published first in 1969.

In 1974 CGA (Canadian Gas Association) was accredited by the Standards Council of Canada and took responsibility for the B149 code. New editions were published in 1976, 1978, 1980 and 1986.

CGA also published in 1968 valve train diagrams under CGA3.0-1968 also known as CSA B203.0 "Definitions and General Field Recommendations".

1n November 1989 CGA published CAN/CGA-B149.3-M89 code which brought together for the convenience of users the previous three codes. This code was reprinted with minor corrections in July 1990 and reaffirmed in 1996.

Since the CGA was amalgamated into CSA, CSA took over the responsibility for publishing of the code under CAN/CSA-B149.3-00 (January 2000)

The other two codes B149.1 and B149,2 were also rewritten and published as
CAN/CSA-B149.1-00 Natural Gas and Propane Installation Code
and
CAN/CSA-B149.2-00 Propane Storage and Handling Code.

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QUESTION: 15. WAS ANYBODY CONSULTED DURING THE DEVELOPMENT OF THE B149.3 CODE?

The latest (January 2000) issue of the B149.3 code was prepare in consultation with the following organizations:

- Technical Standards and Safety Authority, Ontario
- SaskPower Corporation
- Newfoundland Government Service Centre
- BC Ministry of Municipal Affairs
- Alberta Municipal Affairs
- Human Resources Development Canada
- Manitoba Labour
- Government of Northwest Territories
- New Brunswick Department of Labour
- Prince Edward Island Department of Labour
- Regie du batiment du Quebec
- Nova Scotia Department of Labour
- Government of Yukon Territory
- CSA International
- Enbridge Consumers Gas
- Barry Bowman Mechanical
- Gaz Metropolitan Inc.
- BC Gas Utility Ltd.
- Union Gas Limited
- Northwestern Utilities Ltd.
- Centra Gas Manitoba Inc.
- ICG Propane Inc.
- Propane Gas Association of Canada
- Mutual Propane Limited
- D.J. Stainrod & Associates
- Selkirk Metalbestos
- Engair Manufacturing Ltd.
- Underwriters Laboratories of Canada
- MJS Mechanical
- National Research Council Canada
- Maxon Corporation
- J.A. Roberts and Asosciates
- Ron Shorten Associates
- Eclipse Combustion

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QUESTION: 16. HOW COMPLETE AND UP-TO-DATE IS THE B149.3 CODE?

ANSWER: The B149 code was designed 45 years ago for boiler applications and represented the state of the art of that time in burner and control technology. Over the years some updates to the code were introduced to address newer control systems (like PLC's) but overall the basic mechanical concept of the code (like fuel train diagrams) have not been changed dramatically.

There are some significant differences between the B149.3 code and its European equivalents. There are many arguments in the ongoing debate of which code is "better" or safer.
At the same time the B149.3 does not cover, and most likely will never cover, all of the possible cases of industrial combustion technology, which is rapidly changing in the recent years with ever increasing environmental awareness, as well as efficiency and safety consciousness. In, addition, the modern combustion control technology and automation solutions seem to be always ahead of the code and always pushing its envelope.

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QUESTION: 17. WHY HASN'T ANYBODY HEARD ABOUT THE B149.3 UNTIL NOW?

ANSWER: Since the gas safety in Canada is a matter of provincial jurisdiction each province developed over the years its own system of dealing with this subject including provincial safety standards and permits which pre-dated the B149.

The B149 code on the other hand, has never been elevated since its inception to a National Standard and given the associated enforcement powers to override the provincial standards. Consequently, it was considered in the past to be only a guideline. Due to its duplication with provincial standards it was simply not used and not enforced.

Since the last publication of the code in January 2000, which included consultations with the provinces, the B149 code has been accepted by the Interprovincial Gas Advisory Council with the intention that it will be submitted to the Standards Council of Canada for approval as a National Standard of Canada. Once this process is completed the code will be enforceable equally throughout the country and will override any existing provincial standards.

Although not enforced by the government, the B149 code has been used for many years as a good design practice by many industrial combustion equipment designers and manufacturers. The B149.3 compliant fuel trains can be readily found on many utility and power boilers in pulp and paper industry, chemical and food industry, power utilities, and institutional steam plants. Similar designs made their way to various other appliances such a rotary kilns, drying kilns, heat treat furnaces, industrial air heaters, liquid heaters, gravel dryers, thermal oxidizers, just to mention a few.

The petroleum industry however, stayed seemingly unaware of this trend until now. Based on our observations, many petroleum plant designs pre-date the introduction of the B149 code. So do many appliances, which are still in use and production today. Their burner and control technology seemed to have remained frozen over the years and is really outdated in today's standards.

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QUESTION: 18. WHY IS PETROLEUM INDUSTRY USING OUTDATED COMBUSTION TECHNOLOGY?

ANSWER: It seems that petroleum industry got used to operationally dealing with the problems associated with outdated appliances, such as flame blow-backs, unreliable light-off, poor mixing, high emissions, low efficiency, no flame supervision, manual lightoff, etc., and consider them part of normal operation. It is probably thanks to rigid petroleum industry standards and personnel training that on one hand these outdated appliances are operated with relatively low incident levels, and on the other hand are considered to be reliable, standard and in no need of any improvements.

It also seems that the reason that new appliances are still being build based on old specifications and old control technology is not because better technology is not available, but mostly because the petroleum industry is reluctant to try it.

It is fair to state based on our observations that the perception of safety, reliability and acceptable level of performance of gas fired appliances is significantly different in the eyes of the petroleum industry than it is in the eyes of many other industries, burner and combustion system manufacturers, and especially in the eyes of authorities responsible for the gas safety.

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QUESTION: 19. CAN THE EXISTING APPLIANCE DESIGNS BE IMPROVED, AND WHY WOULD WE DO IT?

ANSWER: There is definitely room for improvement in the design and efficiency of existing gas fired appliances used by the petroleum industry. Perhaps the possible improvements in the fuel efficiency of some of these appliances can be combined with the upgrade of gas safety components in such a way that there is a net economic benefit to the petroleum industry plus a significant reduction of greenhouse gas emissions, in other words a win-win scenario.

There is no question that new appliances can be designed and delivered to meet the requirements of B149.3. Even remote sites with limited power or no power at all can be equipped with systems designed for such environment. There are existing technologies which are well proven and capable of achieving this task. If the improvements in gas safety could be combined with improvements in energy efficiency and reduction in greenhouse gas emissions without sacrificing the reliability the choice would be clear.

The first step to success in this respect is in the change of perception of the industry that such improvements would not jeopardize the existing operations.

The second step would be to actually develop, test and optimize solutions for each specific type of appliance in such a way that they can be standardized and easily manufactured.

Petroleum industry places currently its expectations on equipment manufacturers to undertake such development. The reality of the manufacturing industry however, is that it is an extremely fractured (over 100 small fabricating companies in Alberta alone), low margin business with limited engineering capabilities and no R&D capabilities or funding, trying to keep up over the last few years with the market demands created by large capital expenditures of Alberta's petroleum industry.
This type of industry is geared towards the lowest possible cost replication of existing designs and has no interest, capabilities or demand to improve these designs.

Since the petroleum industry has the most in stake to improve its existing appliance designs both from safety, efficiency and environmental point of view, it is the petroleum industry itself which should undertake a combined effort through CAPP to come up with industry-wide solutions.

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It is also the petroleum industry (CAPP) which should own the standardized appliance designs, obtain certification for these solutions and simply use the existing manufacturing infrastructure to replicate these designs on a competitive basis. We believe that this objective can be achieved at a relatively low cost per appliance and with long term safety, efficiency and environmental benefits to the entire industry.

A possibility of government involvement in funding this development under Kyoto Agreement, or similar program umbrella should be investigated.

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QUESTION: 20. WHEN IS THE CODE B149.3 CODE APPLICABLE AND WILL THE EXISTING INSTALLATIONS BE GRANDFATHERED?

ANSWER: In paragraph A.1.5. the B149.3 code specifies:
"The requirements contained in this Code, including valve train diagrams, apply
(a) to new non-certified appliances and equipment of all inputs for which there is no approved standard;
(b) when the upgrading of an existing Certified or non-certified appliance is required; and
(c) to programmable logic controllers or microprocessor-based controls used for flame safety."

Clearly the safety requirements are applicable to all new installations and will have to be incorporated into all existing designs.

The industry expectation is that all existing appliances will be excluded from these requirements in other word "grandfathered". According to the code it is true as long as such appliance is not upgraded. The question always asked here is: what constitutes and upgrade?

The following definition can be used in response:
- any work on an appliance fuel train, burner, gas safety controls or burner management system which involves replacement of existing parts with parts of the same make and model, or any work involving calibration and setpoint checks of existing instrumentation or repairs parts to as-original condition is considered maintenance work and does not require appliance to be re-certified.
- any work on an appliance fuel train, burner, gas safety controls or burner management system which involves replacement of existing parts with parts of different make or model, or any work involving changes to calibration or setpoints of existing instrumentation or changes to the configuration, and sizing of gas piping or appliance venting systems, is considered an upgrade and requires appliance re-certification.

There has been lately in BC an interesting development is the area of "not-grandfathering" of existing equipment from B149.3 upgrade requirements which we feel is important to bring to the attention of the industry. This development had nothing to do with the gas safety authorities but rather with the insurance underwriters of petroleum industry companies. It seems that gas safety aspects of plant operation have been identified by some of the insurers as a potential for increased liability exposure. Some of the insurance companies started conducting safety audits of industrial plants including audits for gas safety compliance with B149.3 code. The audits are conducted as part of the insurance policy renewal

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process and result in a list of deficiencies which need to be fixed within a specified period of time. The policy renewal and continuing coverage is then made subject to meeting this deadline by the owner. We know of at least of one upgrade project which was started that way.

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QUESTION: 21. WHAT DOES APPLIANCE APPROVAL PROCESS INVOLVE?

ANSWER: The interviews which we conducted with all three approval agencies indicate that their primary focus is on certification of appliances at the point of manufacturing. Clearly this focus comes from common practice of approval of consumer type mass produced appliances

In the ideal world, the approval agency would like to have a sample of each appliance model shipped to their designated approval facility for testing. The testing which involves both non-destructive and destructive methods is conducted by the agency according to pre-established criteria. Once the testing is completed to the satisfaction of the applicable standards a blanket approval number is issued and the appliance can officially carry a certification mark for installations throughout Canada and the US. The entire process described above is obviously designed for portable or semi-portable appliances such as space heaters or components such as valves.

In case of larger appliances typical to the petroleum industry such approach is obviously not practical not only due to the limited handling capabilities of testing laboratories but also due to lack of utilities, process load and other equipment this appliance is designed to work with at its final destination. In such case approval agencies help the manufacturer in implementing a testing and quality control plan for production of this appliance model in the factory.
We understand that such approval process can cost about $30,000 per each appliance model.

The process of approval of non-certified one-off engineered appliances is however totally different and varies from province to province. It is based on an assumption that the design is prepared and checked by a qualified engineer and involves submittal of documentation such as P&ID's , mechanical layout drawings, electrical drawings, or ladder logic diagrams along with application and appropriate fee to the approval agency for review. In BC, to use an example, this process is relatively straight forward, and cost structure is based on the appliance rating (maximum $460 per approval). After few days drawings are returned to the manufacturer along with a special appliance permit called the SG-Tag. This temporary tag is to be attached to the appliance and only removed by the gas safety inspector during the field approval.
The gasfitting contractor installing the appliance must take out a separate Gas Permit which allows him to make the actual gas connection to the appliance. Once the appliance is installed in the field by a certified gasfitter, gas inspector is called in to perform the field installation approval and to attach a special BC Gas Safety approval sticker to the appliance in place of the SG-tag. Depending on the

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location of the installation the entire special approval process of a non-certified appliance costs between $1000 and $1500 and is for many years a very common practice in BC accepted also by some of the petroleum industry plants.

In Alberta however, this process is presently not that simple. Since the gas safety officers are not qualified to do the approval of appliances, the special approval requirement must be referred to one of the three approval agencies specified in the STANDATA bulletin.

Our experience with this process on a recent upgrade project in Alberta is as follows:

- Underwriter Laboratories – our inquiry was redirected to ULC office in Ontario, and after approximately 3 weeks of discussions and considerations ULC advised that they do not have necessary expertise and manpower to conduct field approvals of appliances in Alberta.

- Intertek Testing - responded very quickly and professionally to our inquiry out of their Power Group corporate office in New York and submitted a proposal for field approval work at US$1500 per day rate with about 4 days of investigation plus travel time to site in Alberta of one of their inspection officers from Vancouver, a total bill of at least CAN$15,000

- CSA International – Edmonton office submitted a proposal for CAN$3500 to do the special field approval out of their Edmonton office. This is the approval which the plant decided to accept.

Upon submittal of preliminary project documentation in form of P&ID's and process description a site meeting with CSA representative and inspection was arranged. The meeting was extremely informative and useful to all parties in establishing a working relationship between the plant and CSA and in understanding the requirements of the approval process. The only problem which was experienced was the fact that due to the CSA's large workload the approval process is already into its third month. We understand that CSA is trying to address its shortage of staff to handle field approvals.

To summarize, we conclude that the existing infrastructure of the certification bodies is almost non-existent and not set up currently to handle special field approvals of uncertified appliances as stipulated by the code and STANDATA bulletin. The cost and timing of such approvals in not acceptable to the industry. Also in our discussions with all three organizations we did not encounter any evidence of a standardized approach to the approval process in form of list of requirements, applicants guide or any similar documentation.

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Further discussions with certification bodies are necessary to establish how the field approval of non-certified appliances process could be brought into reality and what type of infrastructure will be provided to handle the workload.

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QUESTION: 22. WHO ARE ALL THE PARTICIPANTS IN THE GAS SAFETY IMPLEMANTATION PROCESS?

ANSWER: Through out discussion with the industry on this subject we managed to identify the following organizations which are or will be involved in some way in the Gas Safety approval process:

- operating companies
- consulting engineers
- equipment integrators and manufacturers
- approved component suppliers / distributors
- certification bodies (CSA International, ULC, Intertek)
- codes/Standards Organization (CSA)
- provincial governments
- municipal governments or accredited Inspection Agencies
- certified gasfitters and gasfitting contractors
- Workers Compensation Board
- insurance underwriters

Clear understanding of role and responsibilities of each of these organizations should be established.

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QUESTION: 23. WHAT IS THE INTENT OF THIS PROCESS?

ANSWER: Through our discussions with various participants we come to a conclusion that presently there is not much common ground in the perception of the ultimate intent of this process. There seem to be two camps representing opposite opinions and interests: government vs. industry and the discussions tend to lead towards confrontation.

For the sake of bringing all involved parties to the same table it is important that a middle ground be found based on some mutually agreed intent.

The following definition could be used for example as a starting point of such discussion:
"The intent of this process is the increased operational safety of gas fired appliances, through standardization of their design, approval, installation, startup and operation".

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QUESTION: 24. WHAT ARE THE UNDERLYING ISSUES IN THIS PROCESS?

ANSWER: The underlying issues in this process are that of operational safety considerations as well as of liability for that safety.

It is difficult to arbitrarily decide in many specialized cases of petroleum industry processes which technical solution will provide a better operational safety of gas fired appliances. In all depends on the process requirements, personnel training, maintenance, appliance location, lack of electrical utilities and function. There is no doubt that there are some instances when tripping an appliance according to the gas safety code may create a larger safety hazard than leaving it on, simply because of the upset to the process which this action would create.

This is an argument which petroleum industry often uses to prove that the implementation of the B149.3 code would not be beneficial to the petroleum plant operations.

To answer this concern we may suggest that the B149.3 code should be applied with caution as there will be some instances in which portions of the code will simply not fit the application. Such instances should be identified through HAZOP reviews and carefully assessed by a qualified engineer through a simple test: "how can we apply the B149.3 to this appliance without sacrificing the process?"

From an engineering perspective the significance of trying to apply the code to the best of ones abilities carries a totally different liability implication then discounting the code all together. As professionals we are obliged to make sure that our designs comply with applicable standards as much as possible and only when we see a problem with this approach we can make a decision to vary from these standards.

It is a fact that the B149.3 code is becoming widely accepted by various industries and government levels throughout Canada. It is also a fact that although the code does not cover at present many of the specialized industrial combustion processes, it is constantly being amended and increased in scope. Therefore it is not a question of *"if?"* but only *"when?"* will the B149.3 become a nationally recognized standard for all combustion applications and therefore enforceable through legislation. It is also a fact that the enforcement of B149.3 has already begun.

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In the process, the liability for gas safety if shifting among all involved parties. If there was an accident without an existing standard, then in eyes of the law the government could be liable for not creating such standard to protect the public.

If the standards exists and the government can show that it is being enforced through inspections, fines, etc, then the liability is shifted to the corporation and then within the corporation to engineers who are responsible under the Code of Ethics to uphold the law and use applicable standards. This is a very important consideration with far reaching and very serious potential consequences which need to be addressed in the future discussions about the applicability of the B149.3 code to the petroleum industry.

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QUESTION: 25. WHAT APPROACH COULD BE USED TO IMPLEMENT B149.3 CODE IN THE PETROLEUM INDUSTRY?

ANSWER: Based on the above discussion we identified the following potential action ideas:

PERSONNEL
- Define equivalency between the petroleum plant personnel currently responsible for gas piping installations and First Class Gasfitter Journeymen qualifications

- Train plant personnel to become in-house Class I Gas Safety Officer based on equivalent to 5 years First Class Gasfitter Journeymen qualifications

- Provide courses to engineering and plant personnel on design, certification, operation and maintenance of B149.3 compliant appliances

- Provide accreditation to the petroleum companies engineering departments to perform in-house gas safety audits, inspections, and installations in compliance with the code

- Promote gas safety code awareness at all corporate levels.

EXISTING EQUIPMENT
- develop standard procedures for evaluation of existing equipment and installations for compliance with the gas safety codes.

- perform plant and field equipment gas safety audits, identify and prioritize areas requiring immediate improvement of safety versus long term upgrades.

- identify areas in which efficiency and emissions from existing appliances could be increased.

- research methods of upgrading existing appliances and establish Cost/Benefit ratio's and ROI periods. The energy efficiency components can fuel the safety concerns.

- prepare/evaluate standardized designs for equipment improvements

- obtain CSA pre-approval for proposed changes

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- perform upgrades

- monitor improvements to prove benefit and increased safety

NEW EQUIPMENT
- review current specifications for various petroleum industry equipments and identify level of compliance with applicable Gas Safety Codes

- identify potential efficiency, safety and emission improvements

- propose changes to system specifications for new equipment

- obtain design pre-approval from Certifying Bodies.

- prepare new designs for appliances.

- implement new design through competitive outsourcing

- monitor performance of new appliances after installation.

GOVERNMENT
- continue discussion with provincial gas safety authorities regarding methods of implementing the B149.3 code in the petroleum industry environment

- discuss and apply for corporate accreditation under Gas Safety Act (similar to municipalities or inspection agencies)

- research and obtain government funding for improvements of appliances.

CERTICIFATION/STANDARDS BODIES
- participate in the development of the new TIL which will address the special requirements and environment of petroleum industry

- discuss with certification bodies practical methods of certifying appliances

- develop standardized review and certification procedures

- negotiate standard fee structure and timeline for certification of appliances

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