

Final Report

Flaring Mitigation Centre Market Assessment

**Confidential to
PTAC Petroleum Technology
Alliance Canada**

**Prepared by
Ian J. Potter
C-FER Technologies Inc.**

**Mel Strosher
Alberta Research Council**

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EXECUTIVE SUMMARY

The market assessment was designed to provide quantitative information describing to what degree a Flaring Mitigation Centre (FMC) was required and what the scope of its operation would be. To ensure that all interested stakeholder groups had an opportunity for input and that the survey was objective and unbiased, the following survey development process was undertaken with the agreement of the Technical Steering Committee (TSC):

- To facilitate the initiation of both surveys, C-FER/ARC developed a general discussion document for input by both provincial and federal government interest groups.
- The responses from the Government Discussion Document were reviewed to formulate the draft surveys.
- The draft surveys were distributed to the TSC industry members and four equipment vendors to solicit their comments, concerns and understanding of the questions prior to their distribution.

32 of the 241 oil and gas industry companies responded to the survey (13.28%). Based on the June 1999 ST 99-60 data, these responding companies are responsible for 40.8% of the gas flared in Alberta. 21 of the 91 equipment vendor companies responded to the survey (23.08%).

The survey information was compiled, assimilated, then used for the assessment and recommendations for the advancement of the FMC project initiative.

Based on an analysis of the results, it is C-FER's/ARC's opinion that the envisaged role the Flaring Mitigation Centre would undertake is required either fully or partly by the oil and gas industry and the equipment vendors surveyed. This is particularly the case with industry and vendor need for the development of flaring and flaring mitigation technology performance standards and testing protocols.

The requirement for the physical structure of a building, whether permanent or temporary is not so readily clear with a reluctance on the part of the industry and vendors to contribute financially towards a facility. Hence, with the absence of sufficient funding, C-FER/ARC suggests that the FMC be initially designed based on the field investigation of existing and future flaring systems. To aid the vision of the FMC as required by the RFP, the Centre design would also incorporate the provision to investigate other flaring mitigation technologies on an as-required and funding-available basis. Notwithstanding, to assist industry in meeting the expectations of Guide 60, the FMC Group would act as an independent industry advisory body for flaring mitigation systems.

Based on the survey response, C-FER/ARC recommend that a modified Phase I (Project Development and Techno-economic Assessment) be funded primarily from the Federal and Provincial Government's. However, as with the current flaring research, industry and vendors would be encouraged to provide sponsorship.

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1. INTRODUCTION

In response to the PTAC Petroleum Technology Alliance Canada facilitated Flaring Field Testing Facility request for proposal (RFP), C-FER Technologies Inc. (C-FER) and the Alberta Research Council (ARC) developed an project proposal response based on the RFP requirements, PTAC workshop notes and the combined experience of C-FER and ARC personnel. The proposal provided the Proposal Evaluation Committee with some perception on the breadth of the C-FER/ARC project intentions and aspirations for the facility. The proposal document did not constitute a final design, but rather provided a starting point and some perspective on the complexity and issues surrounding the design, development, operation, and most importantly, confidence building and buy-in for the facility, hereafter, the Flaring Mitigation Centre (FMC).

1.1 Objective of Current Investigation

After several meetings concerning the Flaring Mitigation Centre RFP response by C-FER and the ARC, the Steering Committee requested an initial marketing assessment phase to address the business drivers that would discern the requirement, if any, for an FMC, its operational scope and possible utilisation of the Centre. Hence, the overall objective of the project defined herein was to undertake a market survey for a Flaring Mitigation Centre prior to considering any further design, construction and operational specifications. The scope of the project and the envisaged results will:

- Ascertain the industry and vendor reaction to the role of the FMC.
- Establish whether there is justification for the project to proceed to the design, construction and operation phases.
- Determine the likely utilisation of the FMC for equipment verification and/or certification and possibly product development.
- Establish the FMC technology assessment requirements and generic parameters.

1.2 FMC Driver Scenarios

To address the drivers and issues for the motivation and basic foundation for the scope of the proposed Centre, C-FER/ARC suggested four possible scenarios for the future flaring centre initiatives including:

- i. Government Guidelines – ID 99-6 and Guide 60 are implemented by the industry to the minimum required compliance.
- ii. Government/Industry Guidelines – ID 99-6 and Guide 60 are actively implemented by the industry to ensure maximum compliance.

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- iii. Government Regulation – ID 99-6 and Guide 60 fail to provide the required levels of flaring mitigation and the government imposes regulation on the industry.
- iv. Government Regulation with Flaring Fee – Government regulation of flaring is advanced to impose a “fee”-based levy for failure to meet flaring reductions.

These scenarios are not independent and it is C-FER’s/ARC’s belief that the final “solution” will be some compromise based on the results of discussion and survey of the drivers, issues and requirements for flaring mitigation.

2. SURVEY METHODOLOGY

To solicit the differing views of both the oil and gas industry and the equipment vendors, two separate surveys were considered necessary

2.1 Survey Sample

The oil and gas industry sample was primarily drawn from the Alberta Energy and Utilities Board (EUB) ST 99-60 database “Crude Oil & Crude Bitumen Batteries: Monthly Flaring, Venting & Production Data”. Of the companies which report a “Monthly Disposition Statement” (S-2) to the EUB, C-FER/ARC identified 241 for inclusion in the sample.

The equipment vendor sample was drawn from trade directories, industry and government suggested companies and C-FER/ARC contacts. In total, 91 equipment vendor companies from Alberta, other provinces and the USA were included in sample. These companies represent a cross-section of flare manufacturers, oil field equipment and service companies, power generation, consultants and research organisations.

2.2 Survey Development

To ensure that all interested stakeholder groups had an opportunity for input and that the survey was objective and unbiased the following survey development process was undertaken with the agreement of the Technical Steering Committee (TSC):

- To facilitate the initiation of both surveys, C-FER/ARC developed a general discussion document for input by provincial and federal government interest groups. Appendix A contains the resulting Government Discussion Document with the responses.
- The responses from the Government Discussion Document were reviewed to formulate the draft surveys.
- The draft surveys were distributed to the TSC industry members and four equipment vendors to solicit their comments, concerns and understanding of the questions.
- Based on the above, the final surveys were distributed.

2.3 Survey Distribution

To ensure that the surveys reached the selected sample and that a reasonable response was forthcoming an on-going proactive approach was undertaken. The surveys were initially distributed by facsimile. The recipients were also directed to the C-FER Technologies Inc. web site where the respective questionnaires could be downloaded in Microsoft Word[®] and portable document format (PDF). This was followed one week later with personal e-mails with the two surveys formats attached. An initial deadline for survey response was set at 4th January 2000.

Survey Methodology

However, with the Christmas and New Year vacation period this was extended to 10th January 2000. During this extension period, telephone follow-ups were also conducted to increase the response. In this telephone follow-up process it was established that many oil and gas companies were reluctant to respond to the survey due to revealing company confidential information. Therefore e-mails were sent to all companies informing them of the confidential nature and treatment of their response. It was made clear that the responses would be re-combined in one report, and any reference made in the survey to an individual or company would be removed. On completion of the project survey responses would be shredded. Further, if companies were still concerned, they were requested to reply only to questions they felt comfortable with.

2.4 Response Populations

32 of the 241 oil and gas industry companies responded to the survey (13.28%). Based on the June 1999 ST 99-60 data, these responding companies are responsible for 40.8% of the gas flared in Alberta. 21 of the 91 equipment vendor companies responded to the survey (23.08%)

3. C-FER/ARC SURVEY RESULTS ANALYSIS

The correlated oil and gas industry and equipment vendor surveys, with any company names removed, are contained in Appendix B and C respectively. The survey response comments have been randomly transcribed from the original to the correlated format. In addition, Appendix D combines the oil and gas industry survey and equipment vendor survey for similar survey topics. This section provides the survey results analysis that was undertaken by C-FER/ARC.

3.1 Issues Concerning Flaring

Nearly all the responding oil and gas companies (93.74%) expressed an interest in reducing their current flaring operation and achieving emission improvements. When pollutant emissions were specifically addressed, 40.63% had concerns and 53.12% had no concerns. The general comment areas focused on where, if any, the concerns emanated and the possible improvements or advancements that could be made. These included:

- Public health and environmental impact.
- Knowledge of emissions, species, volumes and effects.
- Capability of technology for efficient combustion and pollutant removal.
- Energy conservation.

In the case of the equipment vendors, the vast majority (90.48%) thought that stricter emission guidelines for handling waste gases were required. The vendor comments focused on the following areas.

- The need to minimize environmental impact.
- Public environmental awareness and concerns.
- Adoption of new technology (hopefully theirs).
- Oil and gas company production operations.

3.1.1 Alberta Energy and Utilities Board

Over 90% of the oil and gas industry reported an awareness of the EUB ID 99-6 and Guide 60. With respect to the approach being taken by the EUB with flaring management, 46.88% expressed concern and 37.5% were not concerned. The comments alluded to:

- Concern over the broad approach being taken, extending beyond solution gas flaring to other complex waste gas issues.
- The complexity of some of the Guide 60 issues, such as public consultation, economics and reporting procedures.

C-FER/ARC Survey Results Analysis

- The Guide provides a level playing field for all operators.
- Consultation is important, and is being addressed primarily through the CAPP flaring management committee.

For further specific action or guidance by the EUB, 50% of respondents required none, and 37.5% thought that further aid was required. It was noted that the EUB's clarification document and "Frequently Asked Questions" web site would aid many of the present and on-going concerns and queries. Further guidance was requested for:

- Removing confusion over flare performance, heating value.
- Daily reporting requirements and the possible increased volume impact this might have on provincial targets.

The survey response indicated that the impact of the Guide on industry operations would be varying depending on individual company facilities and current infrastructure. On the field side, some major flares would be eliminated, however, the main concern was with oil production, the modification of existing facilities and well test procedures. On the accounting or administration side, there was concern over the additional resources and time required for the reporting, public consultation and accounting.

For the equipment vendors, 57% were aware of the EUB ID 99-6 and Guide 60, and 75% thought that industry compliance with the Guide would either positively or very positively affect their business. The primary reasons for this positive outlook were the requirement for:

- More reliable equipment.
- Increased sales to meet the Guide.
- A better understanding of flaring and improvement of the public's perception of the industry.

Some concern was raised over the ability of new or alternate flaring mitigation to meet industry investment criteria without an externally forced driver such as environmental compliance.

3.1.2 Voluntary or Regulated Compliance

In striving to meet the EUB's flaring management process of elimination, reduction or efficiency improvement, 75% of the industry respondents believed they would do so voluntarily. There was mixed reaction to the precise nature of this voluntary approach, with many of the comments reflecting a requirement for a balanced system, where some form of regulation maybe required to ensure a consistent and economic approach by industry.

The long terms expectations of the oil and gas industry meeting the reduction proposed by Guide 60 were unknown. Whereas, 72% and 56% expected to meet the 2000 and 2001 reductions respectively, the 2003 and 2007 expectations were 28% and 22% respectively. For these latter time periods, it was more an unknown factor rather than a no response. This point perhaps

C-FER/ARC Survey Results Analysis

highlights the main FMC project objective for the long term flaring mitigation aspirations which may require some considerable effort in technology development, understanding and industry buy-in. It was also pointed out that the flaring reductions were on a total industry-wide or province-wide basis, and not individual company requirements.

It appears industry will be proactive in complying with Guide 60, with 85% undertaking the Guide expectation voluntarily.

3.1.3 Incentive for Support of Flaring Management Process

There is varied reaction as to whether any additional incentive is required for the industry to further embrace the process. The on-going consultation process used by the EUB for the flaring management process is generally supported by industry. Notwithstanding, several industry responses expressed interest in:

- Royalty exemptions, either on conserving current flared gas, conservation projects and/or the use of new flare technologies.
- Technology workshops, tracking and publishing individual company progress.
- Joint government and industry funding for flaring mitigation projects.

3.1.4 Role of Alberta Environment

Nearly 60% of the industry respondents believed that no specific action and/or guidance on flaring was required by Alberta Environment. There was comments noting some confusion over the consistency of procedures between the EUB and AENV, as well as the clarification of jurisdictional areas, specifically modelling.

3.1.5 Oil and Gas Industry Vapour Issues

Within the confidence limits used, the levels of conserved, flared, lease fuel and vented gases reported by the industry are in reasonable alignment to those of the ST 99-60 data. Due to the high levels of venting of gas associated with oil and gas operations, C-FER/ARC specifically requested information on the conditions for what alternative technologies would be considered for utilising the vented waste gas. The main consideration was economic, in some cases with pay back periods. However, other considerations included electric generation options, landowner impact and life expectancy/size of the reserve.

C-FER/ARC Survey Results Analysis

3.2 Technology Objectives

3.2.1 Vendor Confidence

One of the envisaged objectives of the FMC is to be able to evaluate the equipment performance claims of the vendors. The industry response showed a 37.5% confident level and 43.75% neutral level for these claims.

3.2.2 Decision Tools for Equipment Selection

Equipment selection procedures can vary between companies and technology areas. For the selection of waste gas utilisation equipment, the industry response placed the highest importance, in descending order, on environmental compliance, system reliability, system performance and system cost. These selection attributes were closely followed by system availability, vendor credibility and independent advice which were deemed important.

3.2.3 Technology Options and Acceptance

With the many technologies that could be used for vapour management and flaring mitigation, it was important to establish the lightly acceptance or willingness of the oil and gas industry to consider current and new technology. Technologies such as separators, compressors, dehydrators and flares are already common in the industry. The other proposed mitigation technologies, such as membranes, electrical generation and cryogenics were also willing to be considered by industry.

As far as suitable technology, 81% of the equipment vendors believe themselves to be able to supply commercially available equipment that would result in the reduction or elimination of flaring. In addition, 66.7% thought they could improve on the combustion efficiencies being achieved by current flaring practices. Equipment that was up forward to achieve this included improved flares, oil/gas separators, incinerators and micro turbines.

When questioned again about emission and operating standards, 52.4% thought they were either inadequate, poorly enforced or misunderstood. There were also comments on the public perception of flaring controls and also the price driven market place for the technology, *i.e.*, the technology is there - at a price. Nearly all the vendors (85.7%) would consider modifications to their equipment to ensure that future emission and operating standards could be met. This was thought to aid in product demand and be environmentally conscious. However, pre-investment would probably be at a level to reach the mandatory regulations.

C-FER/ARC Survey Results Analysis

3.2.4 Verification/Certification

The use of previously tested equipment to aid in the reduction of flaring was supported by 93.8% of the oil and gas respondents. This was due to the perceived benefits of performance, reliability, substantiated vendor claims and cost-effectiveness. Industry importance was also attached to the independent verification of equipment, where 31.3% and 34.4% of the industry thought it either important or very important respectively. Some companies were willing to field test promising or new equipment themselves, and others desired verification of equipment under similar conditions to their own.

The equipment vendors were reasonably positive about the possibility of an internationally recognised equipment performance/verification certificate. This would provide consistent equipment standards and promote user acceptance. However, for the North American market, the acceptability of a Canadian testing facility was questioned unless formally recognised in the USA.

The equipment vendors used 3rd party certification and verification, 57.1% and 38.1% respectively. The standards groups used ranged from Underwriters Laboratories, US EPA and CSA. 66.7% of the vendors felt that verification of their equipment does or would aid in selling their products. This was attributed to the unbiased nature of independent verification and subsequent industry acceptance. However, the vendors believe the products to be mainly price driven.

3.2.5 Technology Standards

A Government of Canada accredited verification was considered important by 59.4% of the oil and gas industry. This was due to Government recognition of the technology, public acceptance and the role of a standard. However, in some cases industry thought themselves to be in a better position to field approve a technology.

The industry confidence in the operation, maintenance and capabilities of previously tested flare and flare mitigation equipment was extremely high (96.9%). This was felt to lower risk, improve reliability and product confidence.

The equipment vendors were supportive of an independent facility for testing equipment associated with flaring and waste gas processing (85.7%). This was envisaged to be cost effective and provide an independent evaluation of results. Some concern was given about proprietary knowledge and the ability to market. In addition, it was mentioned that facilities already exist for the testing of some technologies.

C-FER/ARC Survey Results Analysis

3.3 Flaring Mitigation Centre (FMC)

3.3.1 FMC Requirement and Role

The requirement for the FMC was equally supported and not supported (37.5%). Further, 25% of the industry were not sure what the FMC was, or how it was supposed to aid them. Areas of concern were:

- Adding another stage of vendor equipment acceptance prior to entering the market.
- Understanding the current flaring research prior to advancing to a test facility.

It was felt that industry would respond to the issue with a government “push”.

The supporters of the FMC initiative thought that:

- It would provide an understanding of science and engineering related to flaring and flaring mitigation.
- It would provide a resource Centre that provided access to reliable and accurate data.
- The FMC would promote innovative technologies and provide confidence in equipment procurement.
- It would show industry diligence and keep the flaring management voluntary.

There was some question amongst both the industry supporters and non-supporters of the FMC regarding the precise scope and size of the proposed facility. Some comments indicated that the current scope was too broad, maybe requiring a decentralised approach and further steps prior to proceeding with such a facility. Included was the need for more standards, codes and guidelines.

The multi-technology focus of the proposed FMC had been questioned as to what types of technology should be evaluated. The FMC supporters thought that all technology that could be used for waste gas control was worthy of investigation. However, the focus should be on combustion efficiency and pollutant control.

One of the main general criticisms of equipment transition from the vendor to the field is its ability to operate under varied conditions. It was suggested in the RFP that standard field conditions should be used as the basis for the FMC operation. However, what is standard? This led to the C-FER/ARC suggested gas preparation module, where all fluid parameters could be varied to provide an equipment operational envelope. When the vendors were surveyed on whether they would wish to have their systems tested under a variety of conditions, 81% indicated a favourable response. This type of testing was believed to provide:

- Rapidly changing field operating conditions.
- An indication of the versatility of the product.

C-FER/ARC Survey Results Analysis

The equipment vendors were 66.7% in favour of establishing the FMC to provide a facility that would:

- Establish factual data for flare performance, minimum standards and test new technology.
- Help transfer the knowledge and understanding of flaring between the industry and the flare vendors.
- Extend the initiative to vapour recovery, *i.e.*, to encompass all waste gas issues and not limit the FMC scope to flaring. A modified title was also suggested – Vapour Recovery Mitigation Centre.

Equipment vendors who did not support the FMC (14.3%) thought that either a low cost portable, field unit was more appropriate than a large facility, or that the FMC should be an advisory and information group.

The equipment vendors were in favour of using the proposed FMC for 3rd party verification and certification by 76.2% and 57.1% respectively. This favourable response appeared to be driven by a requirement for industry acceptance of the FMC and its process. The equipment vendors (66.7%) thought that FMC verification would:

- Set standards for equipment.
- Give consistency to methodology and interpretation of results.

The vendors were concerned with any “consumer reports” type approach, and with the ability of a facility to accurately reproduce the myriad of conditions found in the oil patch. The vendors believe that the FMC would be an aid to marketing (57.1%) and provide a product confidence building tool (66.7%). These issues were based on the FMC ability to help industry and the public with understanding and confidence in flaring. There was concern over the FMC impeding vendor operations (38.1%) since the process could extend decisions on guidelines for industry and take time to undertake the “certification” process.

3.3.2 Other Types of Technology

The majority of industry (85.7%) did not believe there was a need to test any non-flaring technologies at the FMC. Those technologies that were mentioned were already listed in the intended technologies for FMC evaluation.

Other non-flaring operations at the FMC were generally not supported by the industry (56.3%). Flaring was believed to be the primary issue and the focus of any initial development.

The equipment vendors also did not have other technologies that could be tested at the facility (57.1%). Again, any technology that was listed was already under possible inclusion for evaluation.

C-FER/ARC Survey Results Analysis

3.3.3 Methods of Performance Testing

The oil and gas industry was supportive of the independent testing, certification and verification of the performance of flares and flare mitigation equipment (95.2%, 81% and 85.7% respectively). There was a comment on the actual process that would undertake this performance testing, and especially the possible slowness that could result.

Both the industry and vendors were surveyed on the type of assessment that an FMC would use to evaluate equipment. The industry attached most significance to equipment reliability, performance, economics and emissions (in descending order of priority). However, the vendors thought that performance, emissions and reliability were desirable.

3.3.4 Flaring Mitigation

The industry was not in favour of only using equipment that was verified by the FMC (65.6%). However, there was an indication that first consideration would be given to such systems, and that cost was a factor.

3.3.5 Confidentiality

As with any proprietary technology, confidentiality of system performance and operation is often required. On the other hand, vendors must release some of this information to the user's in order to make sales. The proposed equipment evaluations at the FMC would provide detailed information on the system. The industry believed that this information should be made public (68.8%). The industry provided some comments on limiting the confidentiality to subscribers and participants. In addition, if the vendor required a confidential assessment, then they should be prepared to divulge the information to the purchaser. There was also caution urged with educating environment and media groups.

The vendors were more in favour of confidentiality to themselves (57.1%). However, the results could be made public if the product was marketable, *i.e.*, no release of information whilst under development and until commercial. In addition, the who pay's, owns the information principle was common.

3.3.6 Financing for the FMC

Based on the C-FER/ARC designated FMC design, construction and operational phases, the oil and gas industry were in support of a equal share between federal government, provincial government and themselves of the order of about 15 to 25% each. The prime contribution to funding was for the vendors, about 40-50% of the phases.

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The industry were not in favour of paying for previously tested equipment data (71.9%) on the main premise of either participation in the FMC initiative, or expectation that the costs would be included in the purchase of the equipment.

Nor was there support for contributing to the funding of the test facility in order to have access of data (53.1%). Again, any test data should be publicly available.

If the FMC were built and operated, 37.5% of the industry were in favour of a “flaring royalty” and 50% against. Some of the respondents’ comments were:

- Companies requiring the technology would pay the most.
- Contributions from all companies, not just the larger ones to fund the initiative.
- Costs to be borne by vendors.
- Why not incentive rather than penalty.
- Too complicated and difficult to administer.

The direct request for the industry funding of the Centre for its 3-year life expectancy was restricted to 28.1% of respondents. The subsequent levels were in the order of \$10,000/company. Other companies would not commit without further information or concerns over total industry support. 56.3% of the industry respondents would not provide financing.

The vendor’s response to paying for testing costs at an accredited independent assessment facility was supported by 61.9%. However, most (57.1%) did not consider that their payment of the testing costs would aid industry in considering their technology. The vendors were more inclined to have industry pay directly for the testing costs (52.4%).

Based on the C-FER/ARC designated FMC design, construction and operational phases, the equipment vendors coupled the finances into two group, themselves with the industry, and the Government. The government funding would reduce from about 70% to 30% over the project phases, whereas the vendor/industry funding would increase from 30% to 70% over the same phases.

As with the industry response the request for direct funding from the vendors was limited to about 28%, with 61.8% not entertaining any financing.

3.3.7 Site Preference

The industry was in favour of Calgary being the location of the FMC (34.4%). Edmonton also had support (15.6%) but also opposition (12.5%). There was also interest from 25% of the industry respondents to host the facility. Consideration for a temporary rather than a permanent facility was also requested.

C-FER/ARC Survey Results Analysis

The vendors preference was also for Calgary as a location for the FMC (66.7%). With equally mixed reaction about Edmonton (19%).

3.3.8 Information Session

Both industry and equipment vendors were in favour of attending an information session on the design of the FMC (71.9% and 85.7% respectively).

3.3.9 Design Input

There was limited support by industry to become involved with any further direct design and development of the FMC (9.4%). The industry respondents either:

- Did not want to devote time to this role.
- Believe that CAPP should take the lead for them.
- Were already involved in the process.
- Questioned the need for the FMC at this time.

The vendors were more inclined to aid the design and development of the FMC (42.9%) with the desire to:

- Be part of the steering committee.
- Ensure testing protocols and accurate results procedures.
- Set policy and mandate.

3.4 Response to General Comments

The general comments from the oil and gas industry focused in the following areas:

- There is no need for the facility, since EUB requirements for compliance would be met.
- A desire to see a final FMC project and mandate before commitment.
- The need to cross-reference the project with the public health impacts of flaring.
- The need to address elimination of flaring.
- Any further development by industry would be through CAPP.

The equipment vendors made comment regarding:

- The need for facilities and test protocols to ensure reliable results accepted by industry.
- The environment role of the facility in promoting energy conservation rather than flaring.

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- Counter productive procedures that may be generated by the FMC.

4. CONCLUSIONS AND RECOMMENDATIONS

4.1 General Discussion

The uncertain effects surrounding the flaring and venting of waste gas from oil and gas production on the environment and human/animal health has necessitated the need to review, control and minimise the release of the resultant gases. The EUB Guide 60, based on the Clean Air Strategic Alliance recommendations, is the first step in the EUB's flaring management process to reduce, eliminate and make more efficient the current flare systems and operational practices. The oil and gas industry appears to have responded well to the challenge imposed by Guide 60. Led predominantly by the CAPP flaring committee, the industry seems to be fully aware of the need and desire to reduce their current flaring volumes.

Indeed, many companies appear to have reached the initial levels of flaring reduction suggested by the EUB. However, what of the longer-term reduction requirements? 70 to 80% of the industry surveyed is unsure as to their ability to comply with the 2003 and 2007 suggested flare reductions. What is fairly certain is that consultation between industry, CAPP, other interest groups and the EUB must continue to ensure that the Guide's implementation is viable and constantly reviewed. Several survey respondents welcomed the recent FAQ addition to the EUB web site. In addition, further guidance was suggested for reviewing some of the complex areas of the Guide such as public consultation, economics, reporting and technical issues surrounding flaring such as performance and heating value.

As the long term reductions are still in question, the many diverse technologies which are already well known or new, may be able to compete with existing systems to either mitigate or better utilise the volumes of gas currently being flared. So why is the industry not fully embracing the new technologies? There are many reasons, such as economics, change in operational practices and equipment confidence. However, one of the difficulties in advancing the application and implementation of all these technologies is the lack of any concrete incentives, either regulatory or beneficial. The majority of the industry believes they will meet the EUB's flaring management process without Government regulation. However, regulation may be necessary to ensure that all the companies compete on the same level. It was made clear by several industry respondents that the reductions were not for individual companies but industry/province wide.

4.2 Development of Standards and Testing Protocols

Another difficulty in advancing any new technologies is in obtaining accurate performance and field test data to substantiate the claims of the equipment manufacturer or product proponent. This is particularly the case when the product has been developed under controlled conditions, *i.e.*, environment, fuel, and then transposed to the field where the conditions are site-specific and possibly time variable. However, Industry is reasonably content with accepting the vendor's claims of their equipment. But they feel that an additional verification or certification of the

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equipment would be an added benefit. If this process was also focused on certain equipment selection parameters, such as environmental compliance, reliability, performance and economics, the procurement process could be enhanced. Hence, to overcome the uncertainties of fixed parameter/condition testing, both industry and vendors are in favour of establishing the “operational envelope” of the equipment under varying conditions, *i.e.*, gas/liquid levels and compositions. This “operational envelope” would enable correlation with site-specific operational requirements. An additional equipment confidence level was evident in the support of a Government of Canada endorsed verification process. However, in some cases, industry would defer to their own tests under their conditions.

To undertake any verification or certification of current or new flare and flare mitigation equipment, standards, guidelines and protocols are required. This was always thought by C-FER/ARC to be one of the main early components in the flaring management process. Perhaps this advisory step should be taken prior to the construction of a facility. This was suggested by C-FER/ARC in the initial FMC proposal for the Phase I design and economic development, in order to satisfy the vision, mandate and objectives of the FMC. As part of the flaring mitigation initiative, it has been C-FER’s/ARC’s intention to take the lead in the investigation and development of any equipment codes and standards in conjunction with academia, regulators, producers and equipment manufacturers. The independent, external reviews of the standards and protocols would also be sought from specialists in each technology field. Where possible, the implementation of these protocols would be modelled on existing regulations provided by such groups as CSA, API, ASME and SAE.

Third party verification/certification of equipment is currently undertaken by approximately half of the equipment vendors. However, due to the wide variety of technologies there are numerous organisations employed, *i.e.*, USCG, ULC, CSA, ABSA. Each organisation has a specific system and/or subsystem verification/certification role, such as safety, environment and materials. As yet, no known existing organisation would appear to offer the ability to provide performance and reliability testing as desired by the RFP.

One important element in the standards development is the interaction with the EUB and AENV. Since the conduit for the standards application is via Guides and requirements imposed by these provincial groups they must be willing to actively participate and, if appropriate, assist with funding of the standards development process

4.3 Scope of FMC Requirements

In the generation and evaluation of possible building options for the FMC within the original proposal, two main options were initially considered, namely:

- A fully independent facility - consisting of a control room, offices, workshop, conference facilities, storage and auxiliary services. The scope and stand-alone nature of such a facility would readily convey the vision of a world-class site for the evaluation of flaring mitigation technology.

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- A semi independent facility - consisting of a control/data acquisition building at the site, with the workshop, meeting facilities and reporting being undertaken at C-FER/ARC main offices.

In addition, for either of the options, a fully mobile trailer facility with data acquisition and control equipment was also envisaged for specific investigations at various battery sites – with the understanding that the solution gas composition used would only be relevant to the particular site.

From the survey responses received, it seems that a number of the industry respondents appear to have some concern in regards to the size of the facility as posed and hence the overall costs. The options for the facility as laid out in the initial proposal were based on what was deemed to be required with respect to what the original RFP had asked for, and to handle multiple testing of technologies so that long waiting times for testing would be eliminated. However, even with a long-term vision for the FMC, this is perhaps too great a scope for the initial requirements of the Centre.

Perhaps the most important issue, and subsequent need for action, is to follow the EUB flaring management process, *i.e.*, flare reduction, efficiency improvement and elimination. If flares were to be shown to be effective in their operation, particularly in regard to combustion efficiency and pollutant control/removal, then the future EUB flaring reductions may be modified. The current research being undertaken under the auspices of the PTAC-facilitated Flaring Committee has provided an excellent start for this investigative process. However, the transition to a field investigation is still required, especially for operation under varying operating conditions, and with full integration of the flare with its ancillary systems. This should perhaps be the initial practical focus of the FMC. Subsequently, when and if required, the FMC can incorporate the practical investigation of the flaring alternate systems that have entered the market. In the mean time, the FMC Group would act as an industry advisory body for the application of these alternate systems.

4.4 FMC Funding

The concern for FMC size seems to be based primarily on costs, and both industry and vendors believe that government funding should be more focused to the infrastructure costs. This would certainly help to ensure that the facility would be designed and used to test the wide variety of technologies as required, without prejudice.

The industry would seem to prefer the vendors to have paid for any testing of their equipment and subsequently provide evidence of such when trying to market and sell the systems. However, if the majority of funding for the facility were to be borne by a few of the vendors, these sponsors may dictate the focus of testing, and evaluations of other technologies could fall by the wayside. In addition, the cost of the equipment would be eventually passed on to the industry.

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4.5 FMC Scenarios

To address the drivers and issues for the motivation and basic foundation for the scope of the proposed Centre, C-FER/ARC had put forth four possible scenarios for the future flaring centre initiatives. These scenarios will now be discussed.

4.5.1 Government Guidelines

The Government Guideline scenario assumes that ID 99-6 and Guide 60 are implemented by the oil and gas industry to achieve the minimum required compliance. This appears to be the current situation with the near-term flaring reductions having been achieved. However, it would appear that independent guidance might still be required to advance standards and protocols with the establishment of an advisory group. This group would aid industry, vendors and government on the further implementation of Guide 60 by providing information on the application of flaring mitigation technologies. This was part of the original C-FER/ARC FMC proposal. However, the establishment of a full test facility would not be required under this scenario. Funding for the scenario would probably be from industry, possibly through CAPP and government.

4.5.2 Government/Industry Guidelines

The Government/Industry scenario assumes that, in addition to the EUB ID 99-6 and Guide 60, the industry would proactively address the flaring management process beyond that required to ensure the maximum possible compliance. It is evident that some members of the oil and gas industry are following this route by making large reductions in flaring, supporting the current flaring research projects and actively encouraging the investigation of new technology. If this were a similar situation for all industry, the FMC initiative would appear to be a logical next step in the evolving flaring management process. The FMC organisation would cater to diverse company-operating philosophies and focus their requirements into practical results. This scenario appears to be limited by the lack of financial support from both government and industry.

4.5.3 Government Regulation

The Government Regulation scenario assumes that the current requirements of ID 99-6 and Guide 60 fail to provide the required levels of flaring mitigation and the government imposes regulation on the industry. This would lead to major industry implications for oil production, well testing and general operation. The industry would probably be forced to implement flaring mitigation initiatives. The FMC organisation would assist the industry in reaching these reduction objectives. The FMC funding would be either from industry, government or a combination.

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4.5.4 Government Regulation with Flaring Fee

This scenario suggests that the Government requirement for flaring reduction and mitigation technology utilisation is met by imposing a “fee”-based levy for failure to meet flaring reductions. The industry would use the FMC organisation to advance its flaring reduction by utilising effective mitigation technology. The “fee” would be partly transferred to the FMC to fund its operation, as well as other flaring related research on health.

4.6 Recommendations for Advancement

Overall, it is C-FER’s/ARC’s opinion that the envisaged role the Flaring Mitigation Centre would undertake is required either fully or partly by the oil and gas industry and the equipment vendors surveyed. However, the requirement for the physical structure of a building, whether permanent or temporary is not so readily clear with a reluctance on the part of the industry and vendors to contribute financially towards a facility. C-FER/ARC believe this to be due in part to:

- The lack of sufficient information on FMC design.
- The uncertainty over the overall capabilities of the Centre related to industry needs.
- Preconceived notions about the complete initiative, its history and the C-FER/ARC proposal.
- The belief by the industry and the vendors that the other group is responsible.

4.6.1 Suggested Modified Proposal

With the absence of sufficient funding, however, a smaller FMC scope could be entertained. By using a staged technology implementation facility to evaluate one technology at a time is an option that may be acceptable. This could provide testing for the most relevant and required technologies at the beginning, leading to others at a latter time. This would reduce some of the infrastructure costs at the outset, or at least spread them out over a longer period of time. The biggest change would occur in the reduction of operating costs as they were detailed in the original proposed expanded facility costs. It would, however, eliminate any cost reductions that could have been achieved by multiple testing capabilities.

C-FER/ARC suggests that the FMC be initially designed based on the field investigation of existing and future flaring systems. However, to aid the vision of the FMC as required by the RFP, the Centre design should also incorporate the provision to investigate other flaring mitigation technologies on an as-required and funding-available basis. Notwithstanding, to assist industry in meeting the expectations of Guide 60, the FMC Group would act as an independent industry advisory body for flaring mitigation systems.

With reference to the original C-FER/ARC proposal entitled “Field Test Centre for Flaring Mitigation Technology” dated September 1999, the following revised Phase I: Project Development and Techno-Economic Assessment is suggested.

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- Task 100: Standards and Protocol Development – C-FER/ARC, in conjunction with the existing flaring projects, will establish a framework for the development of flaring and flaring mitigation technology standards and testing protocols. Assistance in this development will be sought from current standard development organisations, regulatory bodies, academia and equipment vendors. In addition, C-FER/ARC will examine the verification to certification objectives of the FMC. A clear indication of the merits of this process is required, together with a costing analysis.
- Task 200: Site Selection - Based on the response to the oil and gas industry survey, a review of eight volunteered sites will be undertaken. These sites will be ranked according to suitability based on defined merit criteria. Subsequently, C-FER/ARC will co-operate with the finally selected site owner to establish installation procedures. EUB will be contacted to assess any requirements for new or modifications to the existing battery/refinery permit. C-FER/ARC will contact the necessary utilities companies to design and cost infrastructure for the FMC utility functions. In conjunction with Tasks 300 and 500, C-FER/ARC intend to contract an EPC company for assistance with defining the site preparation and installation details. A risk assessment of the implications of the FMC operation on the host site will also be developed.
- Task 300: FMC Design – The initial details of this task will primarily reside with the type of building and location of staffing. Based on the building options defined in the original proposal and refinement recommended in this report, C-FER/ARC will design and cost the necessary buildings required at the FMC. Attention will focus on the FMC’s ability to provide an integrated evaluation system, with attention to safety, quality of information collection and flexibility of operation. The initial design of the FMC will be developed by C-FER/ARC in conjunction with the Technical Steering Committee.
- Task 400: Management and Staffing – Based on the final FMC design and site location, together with an analysis of the envisaged FMC operations, the final staffing numbers and their professional, technical and administrative level will be defined. In addition, the management control structure, terms of reference, communications system and interaction of the Technical Steering Committee, C-FER/ARC Board of Management and the FMC Organisation will be clearly defined. Issues relating to FMC liability and insurance will also be defined.
- Task 500: Detailed Costing – With the knowledge gained from all aspects of Phase I, an analysis of the follow-on Phases will be determined. Building on the project proposal, a detailed business plan financial analysis will provide the TSC with a clear understanding of the capital and operational costs associated with the FMC.
- Task 600: Marketing and Funding – It was evident from the survey that industry and vendors are unaware or unsure of the vision for the FMC. As a result C-FER/ARC intend to hold information sessions for industry and vendors to seek their buy-in to the Centre objectives and to solicit funding for the FMC. To understand the role that the various flaring mitigation systems can offer in conjunction with individual battery site, in conjunction with Guide 60, a study will be undertaken to address the most appropriate reduction strategy that would encompass both flare volume and number of flare stacks.
- Task 700: Reporting – This task encompasses the reporting aspects of each task, including documentation, engineering drawings and quotations. Dr. Potter and Mr. Strosher will regularly update the TSC on progress to date, as well as causes for concern. At the end of Phase I, a Final report will be generated and presented to the TSC on the complete work undertaken. From this report, the TSC will be able to evaluate progress, and if agreeable, grant permission for the project continuation to Phase II

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- Task 800: Project Management – C-FER/ARC will proactively manage this phase of the project with due care, diligence and professional integrity.

4.6.2 Advancement Plan

Based on the preceding comments, the suggested advancement plan for this project is:

- Acceptance of this report from the Technical Steering Committee and their consensus as to the final distribution of this document.
- Acceptance of the C-FER/ARC modified Phase I proposal, incorporating:
 - The examination and development of flaring and flaring mitigation technology standards and performance protocols.
 - An FMC scope, design and operation workshop to be attended by the Technical Steering Committee and other suitable stakeholder representatives.
 - The full FMC design to incorporate a detailed staged technology implementation for short and long term technology testing.
 - An industry and vendor information session regarding the results of this project, the design of the FMC and its mandate.
- Permission for C-FER/ARC to proceed with Phase I.

Based on the survey response, C-FER/ARC recommend that Phase I funding be derived primarily from the Federal and Provincial Governments. However, as with the current flaring research, industry and vendors would be encouraged to provide sponsorship. Hence, C-FER/ARC recommend that the federal and provincial government groups assess their desire for the FMC advancement and make funding available.

The general project plan is consistent with the original C-FER/ARC FMC proposal, where protocols would be developed, a final design agreed upon and information sessions were to be held. Hence the level of funding required for the advancement plan and the allocation of funds is still as originally quoted.