

# Use of a Benchmark Site Self-Assessment Tool as a Leading Indicator for Tracking and Promoting Process Safety Management in the Canadian Chemical Industry

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The opinions expressed herein are solely those of the author and should not be taken as indicative of the views of the Canadian Chemical Producers' Association or its members.

## Abstract

The Site Self-assessment Tool developed by the former Major Industrial Accidents Council of Canada (MIACC) can be used successfully as a benchmark, not only for tracking process safety management (PSM) performance of individual departments, sites or companies but also for moving the performance level of an entire industry or industry sector. The tool is sufficiently detailed to provide a good indicator of how comprehensive and robust a PSM system is, yet is simple enough for practical application by small companies without a lot of technical expertise.

This paper summarizes the experience of the Canadian Chemical Producers' Association (CCPA) in applying the tool as a leading indicator, first to assess the PSM status of its members' sites and to identify systemic vulnerabilities, then to sensitize senior management and secure commitment to specific performance improvement.

The paper comments on observations, successes and also some of the concerns and issues still to be overcome in applying process safety management to an industry sector.

## 1. Introduction

This paper describes use of the HISAT<sup>a</sup> site self-assessment tool as a leading indicator for tracking and promoting process safety management in the Canadian chemical Industry.

This tool was designed to help the Canadian process industries assess the status of their programs and management systems for control of major accident hazards involving hazardous materials. The tool, which was originally developed under the auspices of the former Major industrial Accidents Council of Canada (MIACC), is now available free of charge from the Canadian Society for Chemical Engineering (CSCHE).

The tool has proved extremely useful in assessing prevention and preparedness aspects of major hazard control within the membership of the Canadian Chemical Producers' Association (CCPA). It has helped not only to identify areas of potential vulnerability but also in gaining the commitment of the association's board of directors to make process safety management a priority during the coming triennial period of the CCPA's work plan.

The paper describes the tool and the steps in its development, then reviews many of its advantages based on the CCPA's experience to date. It also presents some notes of caution regarding use of the tool before encouraging others in the Canadian process industries to try it in examining their own operations.

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<sup>a</sup> HISAT stands for *Hazardous Installations Self-Assessment Tool*, the term originally used by MIACC to differentiate the tool from a similar one for community use. The community tool, CSAT, is now available through the Partnerships toward Safer Communities program of the Canadian Association of Fire Chiefs. (Contact the website [www.ptsc-program.org](http://www.ptsc-program.org) for more information on CSAT).

## 2. Description of the HISAT Site Self-assessment Tool

The tool is best understood by downloading a copy from the CSChE's PSM division website [www.cheminst.ca/division/psm](http://www.cheminst.ca/division/psm) (The current version is still the MIACC document with revised contact information, but it should shortly be available as a full CSChE publication).

Following an explanation of the background to the tool's development, full instructions are provided on how to use it. As PSM terminology can be unfamiliar to some of the target audience, an important feature of the tool is the list of PSM committee members available for over-the-phone assistance, free of charge, for those who have difficulty understanding any of the questions.

A list of hazardous substances and threshold quantities for each is then provided to assist users in determining whether their site clearly fits into the hazardous category. This list was developed by MIACC as Canada had no then regulations covering major hazard control in the sense understood in the United States or the European Union. However, the MIACC list is now being absorbed into the new regulations about to be promulgated by Environment Canada under Section 200 of the Canadian Environmental Protection Act 1999 (CEPA).

The tool then provides sections for identifying the site and also the contact person for any subsequent follow-up. A space is provided for signature, but this is actually optional to allay any concerns over potential liability by those filling out the form. Information provided has been protected by CCPA, the organization handling tracking of responses to date, and only the overall status of the site or aggregate responses to specific questions have been made available when reporting information.

The body of the tool then consists of two sections examining preparedness and prevention respectively.

The *Preparedness* section includes eleven questions derived from the similar MIACC tool for community preparedness (see footnote 1). The questions are divided into three levels: essential, enhanced and excellent (the last may be retitled "comprehensive" for consistency with the current version of the community tool).

The *Prevention* section consists of 125 questions<sup>b</sup>, also divided into the same three levels and examining both awareness and also use of a range of PSM techniques or topics, following the twelve-element system developed by the US Center for Chemical Process Safety (CCPS) on which the tool and the supporting *Process Safety Management* guide are based.

Space is also provided for those completing the tool to indicate where they need help or guidance, and an opportunity is given for any additional comments to be supplied in text form at the end of the document.

## 3. Use of the HISAT tool in Canada

The self-assessment tool was originally developed by the MIACC process safety management (PSM) team to support its recommendation that sites with the potential for major hazmat accidents should follow the approach of the Center for Chemical Process Safety or similar in their own programs for hazard control. This has been explained in a previous paper<sup>1</sup>. The tool featured a series of questions designed to examine site awareness and use of PSM techniques using the CCPS table of elements and components as a template, and based on the two principal guideline documents published by the CCPS at that time<sup>2,3</sup>.

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<sup>b</sup> The number appears to be slightly higher from a simple count, as some of the risk assessment questions are repeated at the top level. There are 125 different PSM questions in total.

Pilot testing of the tool by the Canadian Chemical Producers' Association (CCPA) revealed the need for a PSM initiative in Canada, and the team subsequently developed, with the approval of CCPS, a small guide to support the tool by providing a rapid introduction and overview to PSM and also to the CCPS and its publications<sup>4</sup>. This PSM guide is also now available free of charge in English and French from the CShE website, or in print for a nominal charge.

The tool was subsequently incorporated into MIACC's overall operational plan for major hazard control in Canada, and in 1996-7 was again tested by CCPA, this time with the added participation of the Canadian Fertilizer Institute (CFI)<sup>c</sup>. The results, reported to the 1997 MIACC conference<sup>5</sup>, showed some progress with CCPA since the original pilot testing in 1992, but continued to reveal significant vulnerabilities at some sites and hence vulnerability for the industry as a whole.

So far the tool provided users with a benchmark against which to measure their own status, but was of limited use for establishing priorities for remedial action. The main reason for this was that the tool intentionally covers an extremely wide range of PSM techniques and topics. Despite the qualifier that the questions apply only wherever significant hazard potential exists, it is nevertheless an exceptional site that can truthfully answer each question with the "A" response needed for a "100%" score. The tool at this stage of development this gave the impression to many sites that it was an ideal rather than a practical guide as to what they should do in the short to medium term on which action plans were typically based.

This changed when in 1998 the questions were divided into three levels, following the lead introduced by MIACC's community preparedness team with the similar tool developed for assessing community preparedness. The terminology of essential/enhanced/excellent implied that the first level was just that – essential for any site with the potential for a major accident – and the PSM team was insistent that all questions identified for that level should indeed be considered essential by any process industry site serious about preventing major accidents.

CCPA then included the site self-assessment as part of its process for verification of member performance under the Responsible Care initiative. Members were expected to show to the verification teams that they had assessed the status of their sites using the tool, had identified any gaps at the essential level and had an action plan to close those gaps. (Actually meeting the essential level was not realistic at that time as the tool had only recently been republished using the three-level classification).

Subsequent follow-up by CCPA showed that some sites were reporting that they were unaware of some of the key techniques for risk assessment, despite the hazard potential shown by the materials and quantities present on the site. This led in 1999 to a revision of the essential level benchmark to include the note that "the Process Safety Management Committee recommends that, where a site has the potential for serious consequences – especially offsite – that site should be at least aware of the risk assessment techniques listed under element 4 of the PSM self assessment. In other words, the score for items (i) to (v) of section 4 should be at least 'C'." <sup>d, e</sup>

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<sup>c</sup> CFI conducted its own survey of its members and submitted aggregate results to CCPA, showing the number of responding sites and the number of replies to each question and at which condition of awareness and use. The information was thus valid for the analysis, yet protected the confidentiality of CFI's members.

<sup>d</sup> This change has not yet been included in the actual text of the tool, but communicated separately to users. However, it will be added when the text is revised for publication as a CShE document.

<sup>e</sup> This does not necessarily imply that the techniques should then be applied, but that a competent person, knowing the circumstances at the site, understands the basis for the techniques and when they should be used, and has made a conscious, documented decision that their use is not warranted in that particular case. The competent person does not have to be a site employee. He or she could be located in a corporate office or with a contractor/consultant, so

CCPA had encouraged its members to report progress made in closing gaps as it happened rather than conducting an association annual follow up. However, although some companies were prompt or even enthusiastic in their reporting it was apparent that many were challenged by the preoccupations of reorganization and other business pressures. In 2001 a recheck was therefore conducted with those members who had previously reported gaps, to find how much progress had taken place. The result led to an increase rather than reduction of concern, in that action plans appeared to have stalled for several respondents, raising questions about the effectiveness of the companies' own management systems intended to oversee such performance.

It should be noted here that this is not intended to imply that companies were grossly deficient, or that they or their management practices were unsafe. The verification process used by CCPA to examine and confirm effectiveness of Responsible Care in Canada (the process is somewhat different elsewhere) continues to show that CCPA members are generally well advanced in their understanding of the Responsible Care ethic and application of the corresponding management systems called for by the initiative<sup>f</sup>. It is perhaps more an indication of the challenges faced by companies today in ensuring that systems continue to operate as intended despite the constraints that are increasingly placed upon those charged with the responsibility for making them work.

Nevertheless, the process safety management committee felt obliged to advise CCPA of the possible implications of their findings, using pie charts to show the breakdown of responding sites by MIACC hazard classification and by overall performance using five categories: excellent, enhanced, essential, "almost there" and "in progress". As a result, the CCPA board in June 2002 cited PSM as a priority for the membership in its plan for the triennial period 2002-5, calling for all member sites to meet the essential level as a minimum and to evaluate the utility of higher level questions for their respective circumstances.

#### 4. **Advantages of the tool**

Experience with the tool thus far has shown many advantages, summarized below:

- It is an excellent tool for motivation at the site, company, industry sector or national level, highlighting actual status in comparison with desired performance.
- It is valid for the process industries in general, and not just for "chemical" sites.
- It is available in English and French for immediate download, free of charge, or in print for a nominal fee; the pocket-sized print version has proven particularly useful for use with site operating personnel, stimulating dialogue more readily than an electronic document.
- Over-the-phone support is available for the Canadian process industries from PSM experts, free of charge (note that this is obviously limited in nature, and does not attempt to tell questioners what they should do in controlling hazards at their sites – it does however help them to understand the questions and refers them to guidance materials or resources they may not otherwise be aware of).
- It is a leading indicator, unlike the more common trailing indicators provided by accident history or a major event; it can therefore be used where the database is too small for meaningful trends to be derived on the basis of what has already happened.
- The three-level classification provides attainable benchmarks for companies or sites at different levels of progress, whether they are among the industry leaders or new to managing hazmats.;it considers the effect of human error, even at the basic (essential) level; this is a

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long as the criteria above are met. For more guidance, a reference was provided to the CCPS guideline on hazard evaluation procedures.

<sup>f</sup> For more on this, see the CCPA website [www.ccpa.ca](http://www.ccpa.ca).

notable weakness of some other approaches, where human error is not addressed until the more advanced levels or is left out entirely.

- It is easy to complete; a check by MIACC showed that respondents could typically complete the form in less than four hours<sup>9</sup>, although:
- The effectiveness of the tool is greatly increased by using a team approach, especially where representatives of different disciplines complete the form independently before reviewing their findings as a group; this has been described by Morrison<sup>6</sup>.
- Subsequent follow-up can reveal defects in management systems, where delay in implementing action plans should have been detected and corrected by the system itself.
- Senior executives can relate quickly to HISAT information or comparison presented graphically, e.g. by pie chart, though caution should be used to ensure that they are aware of resource implications if selecting the higher levels as a part of a policy objective.
- The tool has shown added value by revealing gaps that companies had not previously detected through their own internal and external auditing.

## 5. Cautions

The tool has definite advantages, as explained above. Nevertheless, there are some caveats that users should be aware of when considering applying it in their site or organization:

- It is suggested that the tool be used in an exploratory manner to start with, i.e. to gather information and find out what the current situation is. Pressure to compete or to attain a given level of performance should be avoided, as it can all too easily lead to a tendency to simply “check off the boxes” or do only the minimum needed to reach the implied standard. (This last point is a typical concern when standards are used to set a performance floor). It is much more important to find vulnerabilities, even if it takes longer to correct them, than to fool oneself with conclusions about performance that may not stand up to closer examination.
- The tool is not really suitable for use as an annual exercise, since its value diminishes once a given level is attained. (In theory it should be possible to re-examine each point as if it had never been attained, but in practice this is not realistic on an ongoing basis).
- Other techniques are therefore likely to be needed to sustain interest in performance and status in the face of other priorities, once the top level has been met. Trend analyses may be useful, providing the database is sufficiently large to give meaningful information. Reviews of actual incidents and near-misses for root and contributing causes are useful, although they may be limited by the scenarios involved in the cases under study. It seems that an anecdotal approach can be extremely useful in getting and holding attention, introducing or illustrating messages derived from analysis from experience from elsewhere.

## 6. Conclusion

The site self-assessment tool described has been extremely useful in raising the profile of process safety management within the chemical industry in Canada, and would almost certainly have achieved much for the other sectors of the process industries had it not been for the untimely dissolution of MIACC in 1999.

Although it has not been possible to express its value in quantitative terms – the number of accidents or consequences reduced – it is undoubtedly of value in revealing gaps so that they can be addressed rather than waiting for an accident to happen. It is certainly better to use it as a leading indicator of the effectiveness of major hazard control than to wait for a “significant trailing indicator” (e.g., major accident) to get the same executive attention and commitment

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<sup>9</sup> This time is far less than that needed for the CCPS *Prospect* tool, which was examined and felt to be more suited to large companies with full-time PSM specialists than the target audience in Canada. However, anyone who has completed the *Prospect* information should be able to answer HISAT easily in less than an hour.

The tool is free, as is the PSM guide that supports it, and can be completed in the privacy of one's own site (or home!) by anyone – PSM specialist, manager, front-line operator, emergency responder or even government inspector – who is familiar with a site and would like to see how its status compares.

I strongly encourage all process industry sites in Canada to examine the tool and try it, comparing their status against the benchmarks provided by the three levels. I also encourage them, once they have confirmed their findings are indeed valid, to send in a response – confidentially if desired – so that their results also can be included in the database.

For more, stay tuned to the PSM division website.

## References

- <sup>1</sup> Creedy, Graham D. *The MIACC Process Safety Initiative*, Process Safety and Loss Management conference, Edmonton 1993;
- <sup>2</sup> Center for Chemical Process Safety, *Guidelines for Technical Management of Chemical Process Safety*, 1989, ISBN 0-8169-0423-5.
- <sup>3</sup> Center for Chemical Process Safety, *Plant Guidelines for Technical Management of Chemical Process Safety*, 1992, ISBN 0-8169-0499-5.
- <sup>4</sup> Canadian Society for Chemical Engineering *Process Safety Management* guide, third edition 2002, ISBN 0-920804-96-9.
- <sup>5</sup> Creedy, Graham. D., presentation on Safer Communities: Hazardous Installations team report at the Major Industrial Accidents Council of Canada's PPR'97 conference, Toronto 1997.
- <sup>6</sup> Morrison, Lisa M., *Measuring Process Safety to Drive PSM Excellence*, Center for Chemical Process Safety's *Making Process Safety Pay* conference, Toronto 2001.