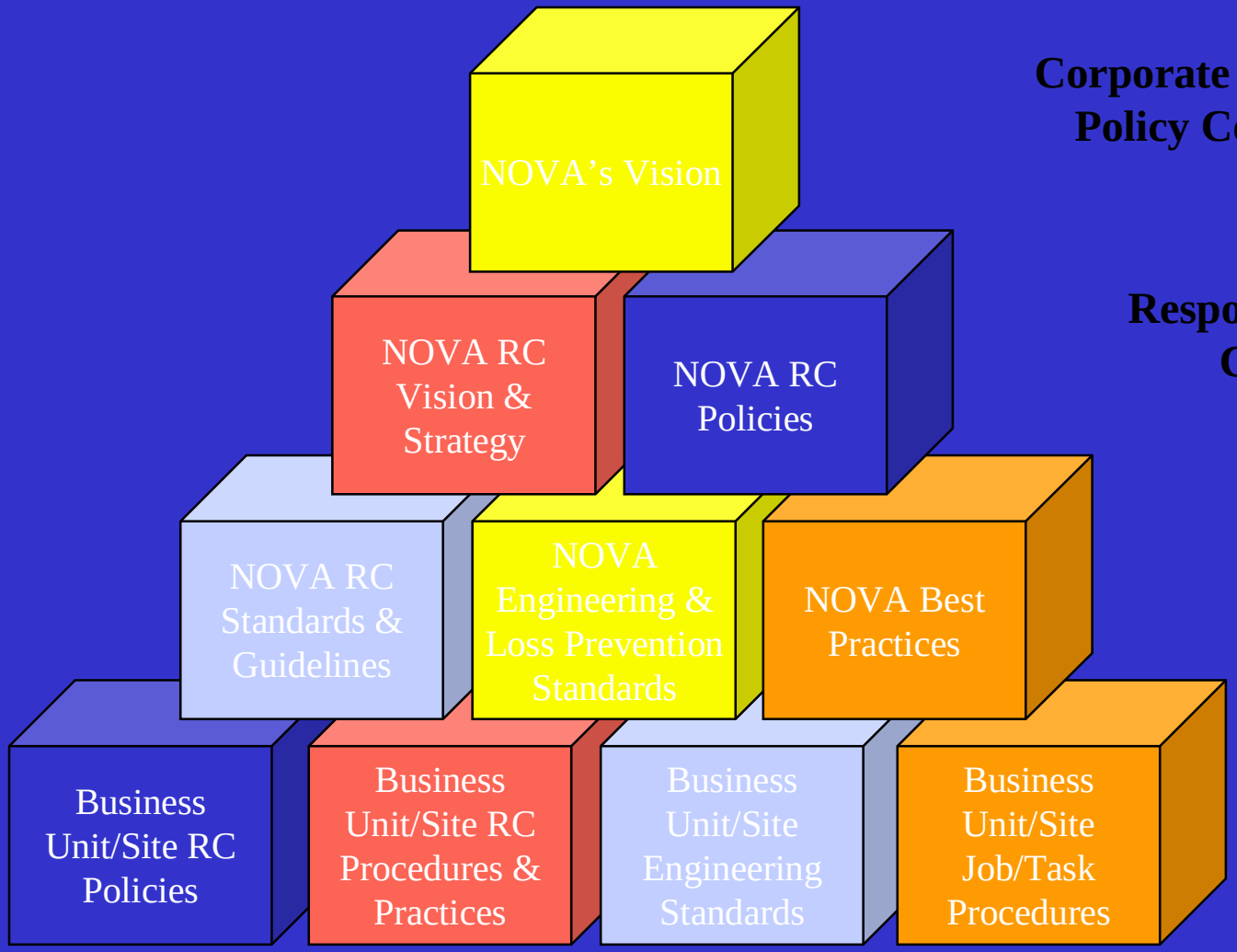
Implementing Process Safety Management To Prevent Major Incidents

CEPA S200 Regulations Workshop

March 2, 2004

RC Standards Hierarchy

Owner of the "A" & "R:"



Corporate Strategy & Policy Committee

Responsible Care Council

Functional Councils

Site/Business Unit/Facility

Centre for Chemical Process Safety

- Division of the AIChE
- Formed in 1985 following Bhopal
- Published Guidelines for the Technical Management of Chemical Process Safety
- 12 Elements with 68 Components
- Comprehensive treatment of the subject
- Basis for CCPA/MIACC/CSChE PSM Guide

CSChE PSM Subject Division

- CSChE is the lead organization in Canada
- Has consolidated the expertise into a cohesive committee
- Provides tools and resources for Canadian Industry
- Conducts a PSM Symposium as part of the Annual Conference (Calgary, Oct 2004)
- Conducts Professional Development in selected PSM topics

PSM HELP ON SITE NOW

(A summary of the contents accessed through the above menu)

Site Self-assessment Tool

Developed by a team of experts for the Major Industrial Accidents Council of Canada, this questionnaire tests for knowledge and use of the important techniques for preventing process-related incidents. Sites can grade themselves as excellent, enhanced, essential or 'not quite there yet.' Essential is the minimum level recommended for hazardous operations, and be warned – it's not that easy!

Getting a quick handle on what you need to do

Process Safety Management Guide

This 30-page guide gives an overview of process safety management, and is available free in Adobe format, or as a handy printed booklet for only Cdn$20.00.

Key tools and how to use them

Here's a summary of the publications you're most likely to need, with explanation of what each does and when to use it.

Where to get more help

Here's how to access many of the resources that are out there to help you with process safety management.

CSChE PSM Division Tools

- Process Safety Management Guide
  - Guidance in setting up the program
- PSM Self-Assessment Questionnaire
  - Leading indicator based on evaluating the program
- Process-Related Incident Measure (PRIM)
  - Lagging indicator based on incidents

Process Safety Management

Third Edition

Canadian Society for Chemical Engineering

PSM Elements

1. Accountability: Objectives and Goals
2. Process Knowledge and Documentation
3. Capital Project Review and Design Procedures
4. Process Risk Management
5. Management of Change
6. Process and Equipment Integrity
7. Human Factors
8. Training and Performance
9. Incident Investigation
10. Company Standards, Codes, and Regulations
11. Audits and Corrective Actions
12. Enhancement of Process Safety Knowledge

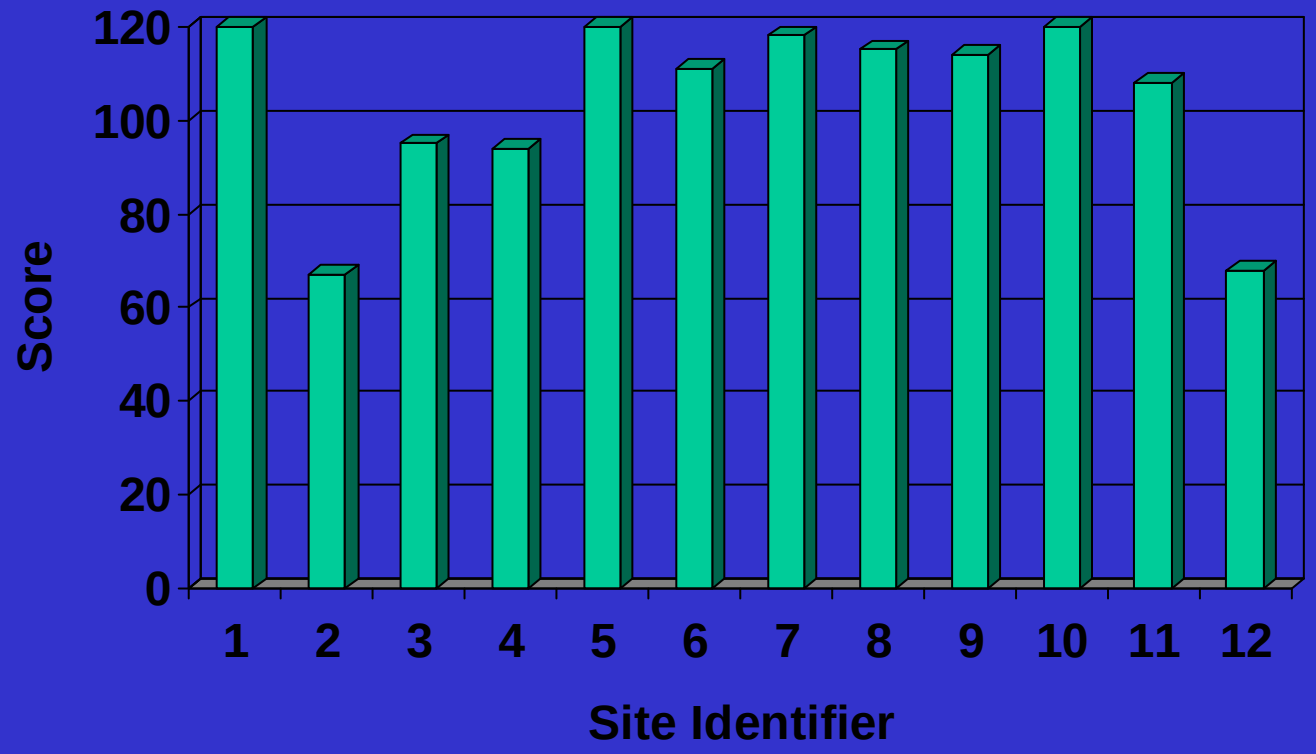
Site Self-assessment Tool

Completing the PSM Questionnaire – NOVA Chemicals' Experience

- One questionnaire for each operating unit/plant
- Completed by a team of Operations, Maintenance, Technical, and Process Safety
- Consensus achieved for each question
- Provides a snapshot of PSM systems
- Can be used to assess the situation on a single site, as well as in a Company, and even the industry or all industries

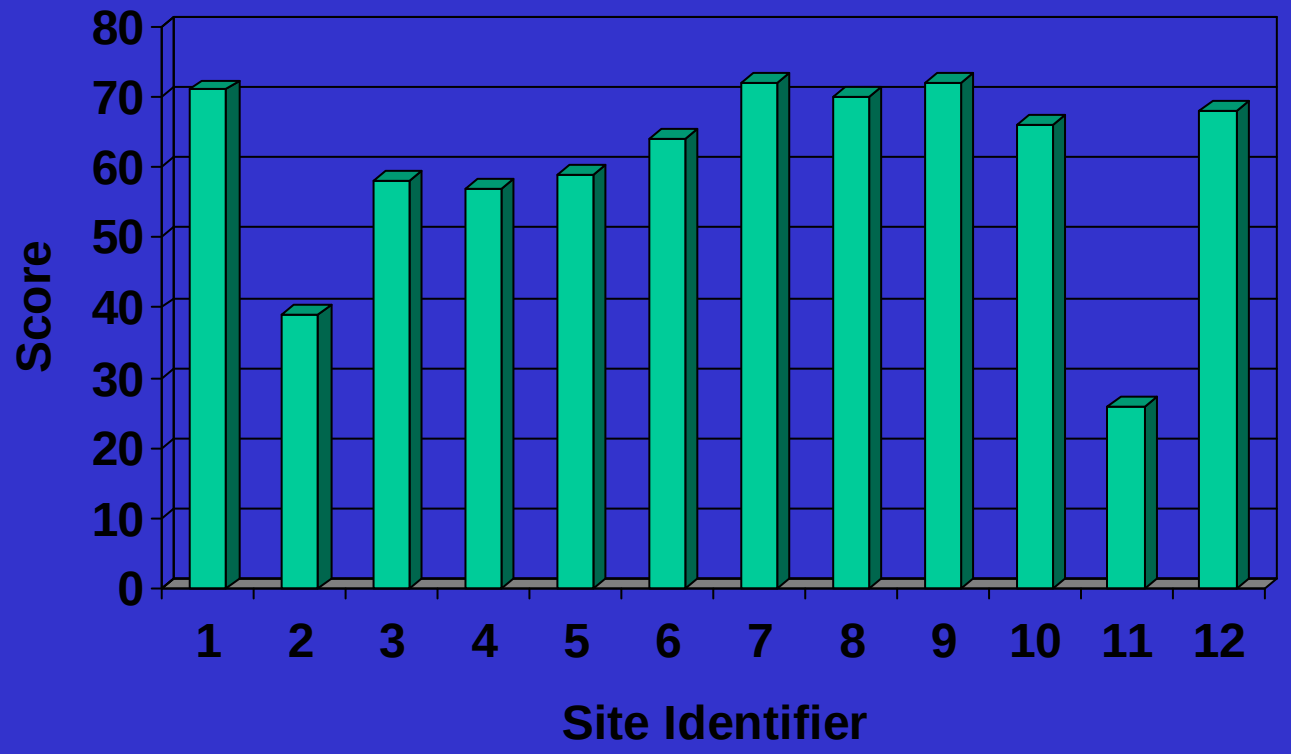
Division Analysis by Site

Essential Level



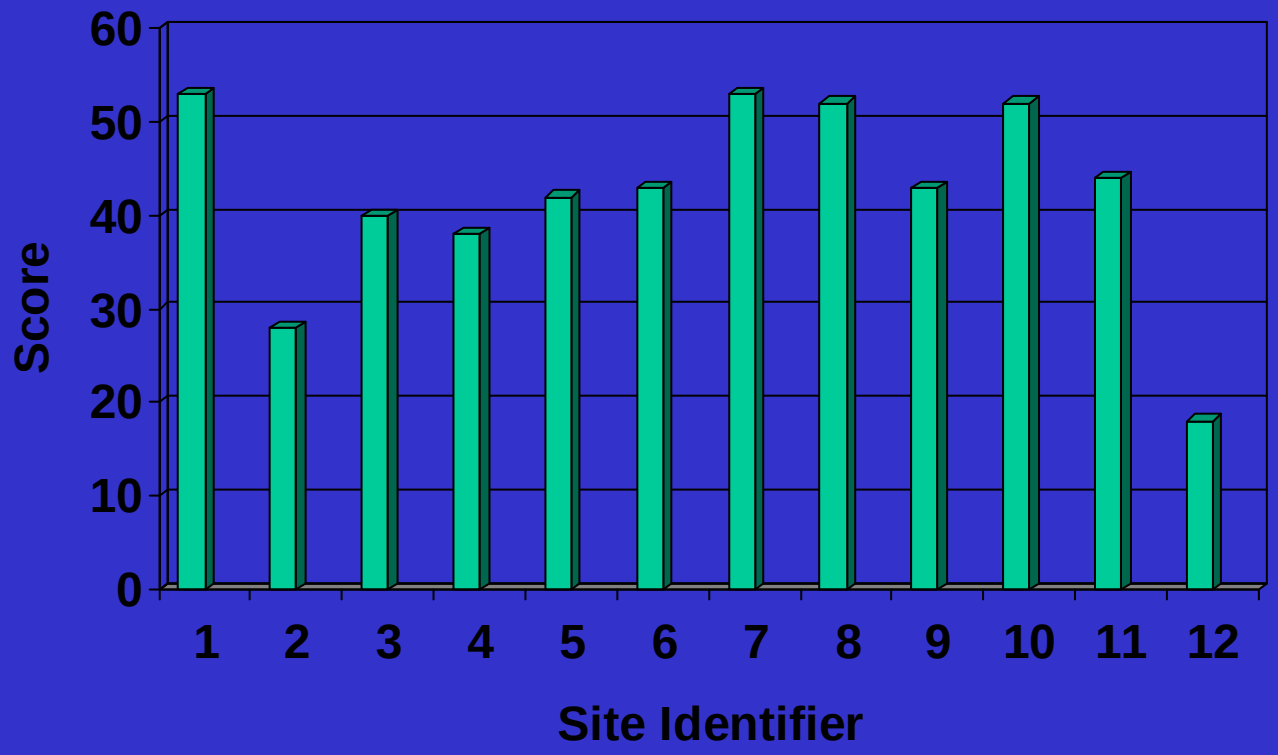
Division Analysis by Site

Enhanced Level



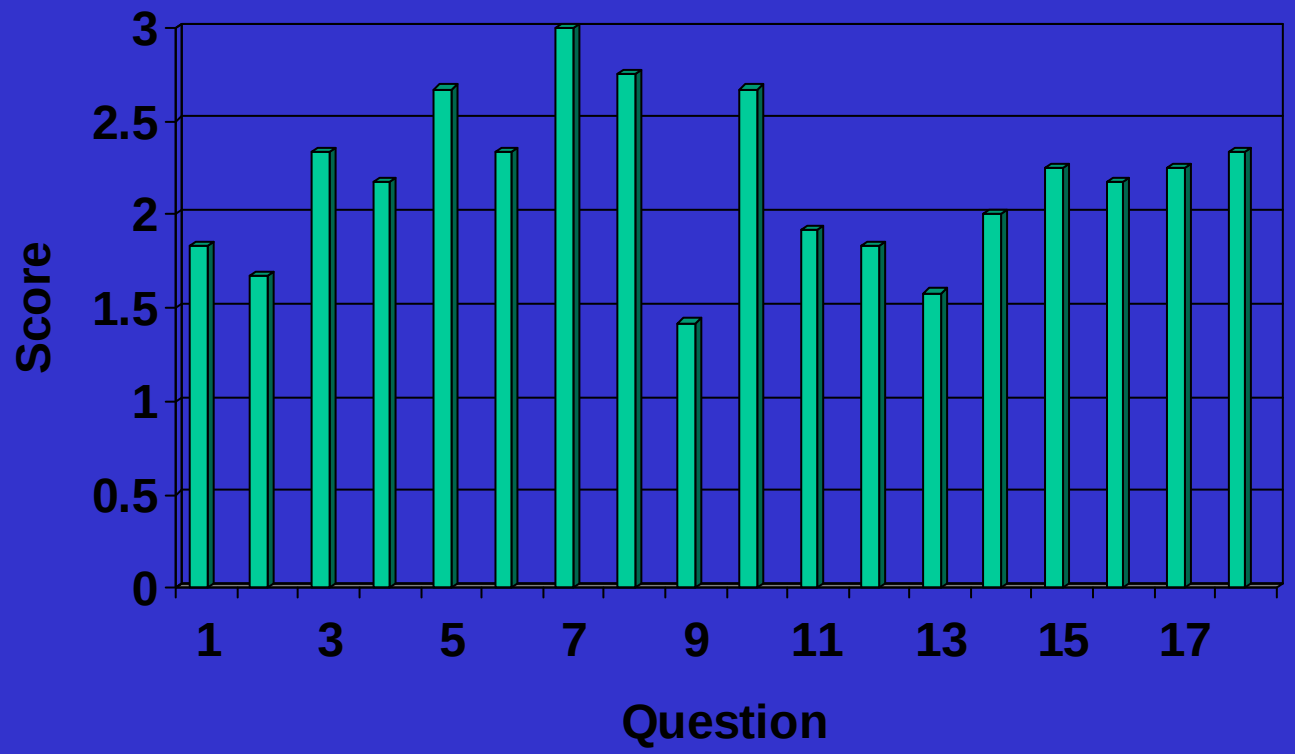
Division Analysis by Site

Excellent Level



Company Analysis by Element

Excellent Level



PSM Performance: PRIM 2001

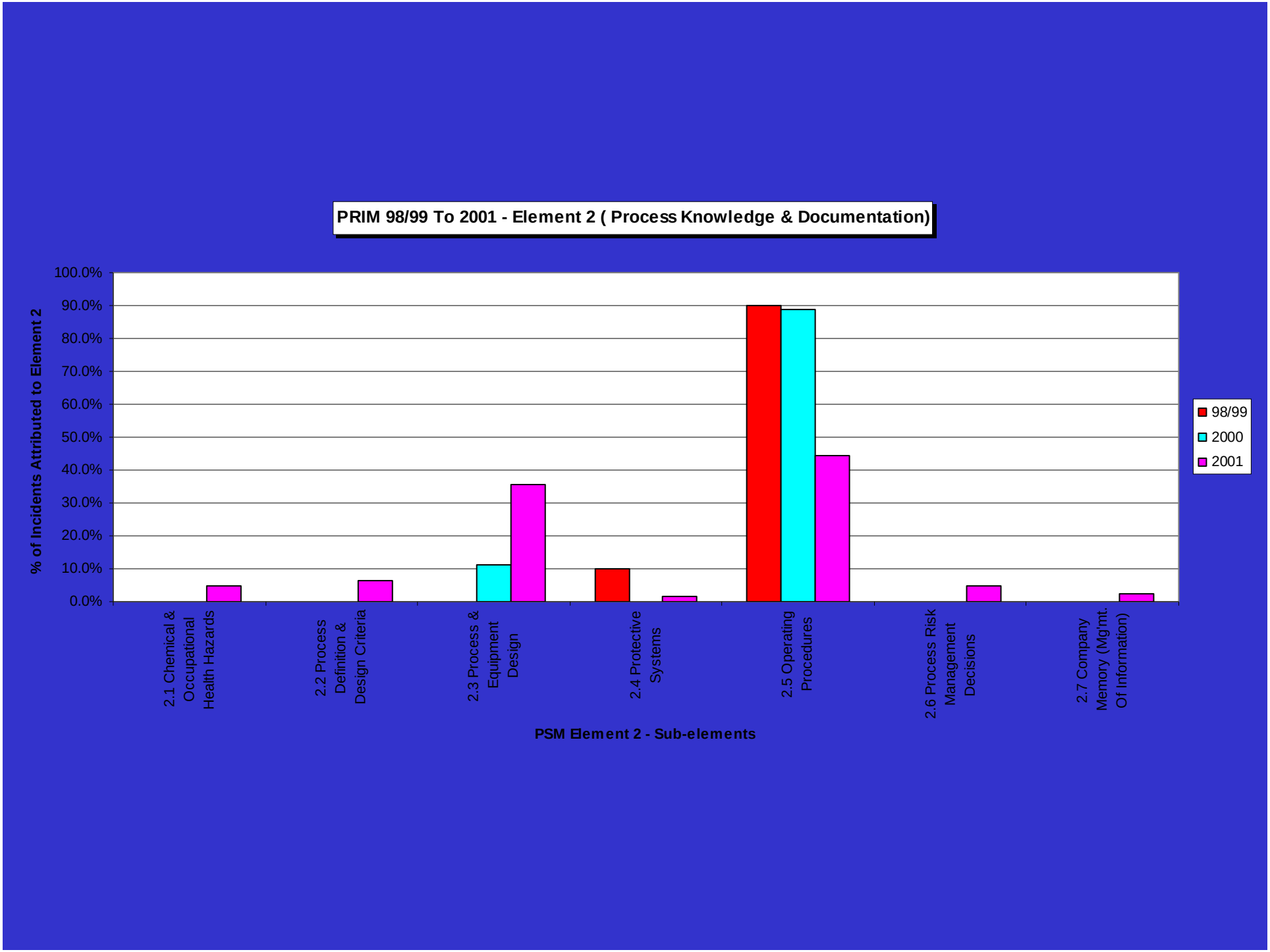
- **Analysis conducted by:**
  - **Lyle Lalonge (Imperial Oil, team leader)**
  - **Rob Cairns (Bayer)**
  - **Steve Coe (Dow)**
  - **Assisted by Luc Piché (Interquisa)**
- **Reports received for 190 sites in 2001**
- **Analysis also completed for 2002**

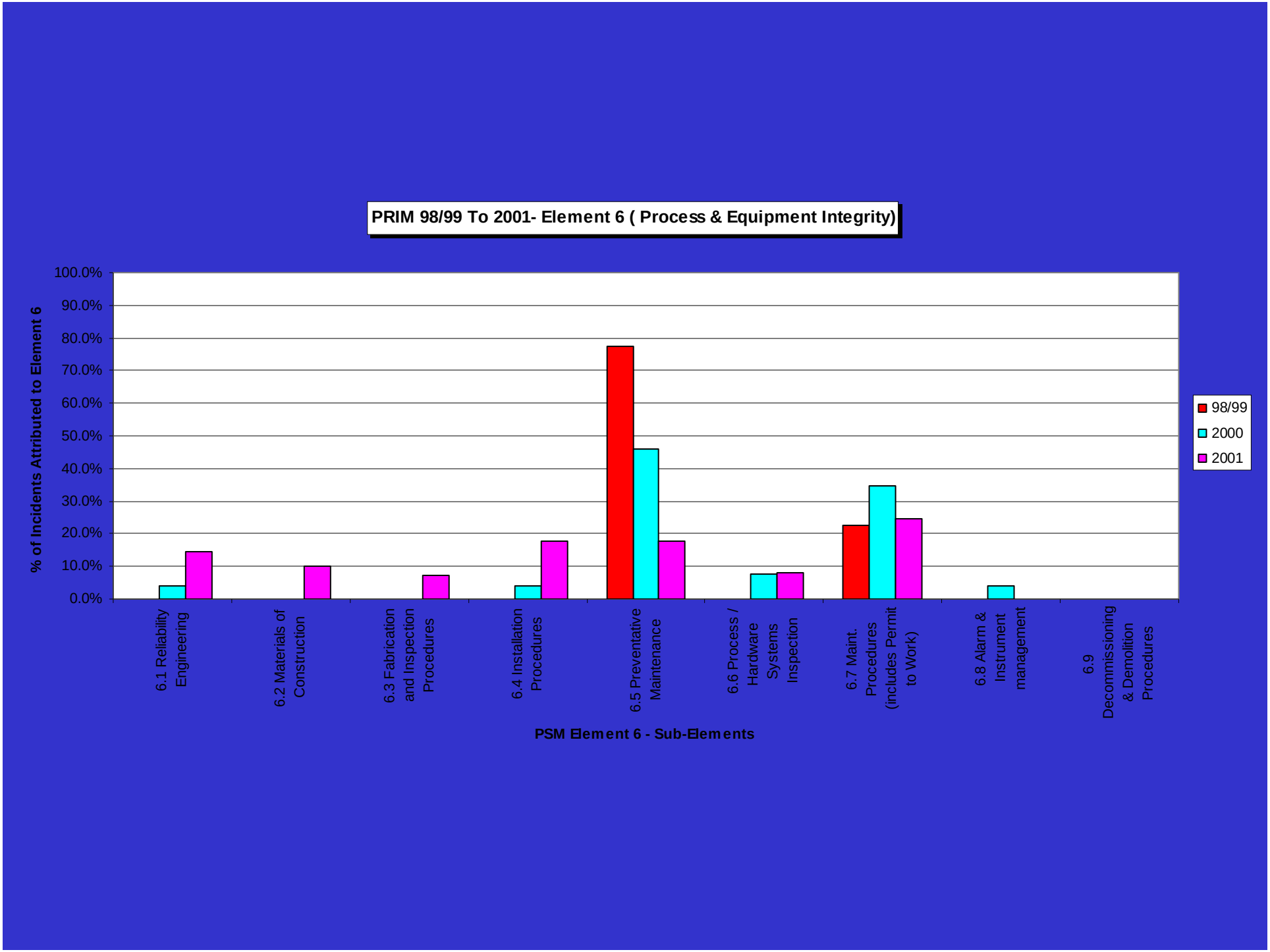
Incident Summary

Type	1999	2000	2001
Critical	2	3	3
Major	26	14	18
Serious	30	35	70
Total meeting PRIM criteria	58	52	91
Other “high learning value”	26	45	124
Total incidents reported	84	97	215
Sites reporting	128	133	190

Conclusions for PRIM 2001

- Primary cause due to:
  - Process & equipment integrity (42%)
  - Process knowledge & documentation (21%)
  - Human factors (11%)
  - Capital project review and design procedures (9%)
- More incidents likely due to better reporting
- Too many lacking enough detail for analysis
- Asked for more detail for analysis in 2002


PRIM 98/99 To 2001 - Element 2 (Process Knowledge & Documentation)
% of Incidents Attributed to Element 2
100.0%
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
98/99
2000
2001
2.1 Chemical & Occupational Health Hazards
2.2 Process Definition & Design Criteria
2.3 Process & Equipment Design
2.4 Protective Systems
2.5 Operating Procedures
2.6 Process Risk Management Decisions
2.7 Company Memory (Mg'mt. Of Information)
PSM Element 2 - Sub-elements


PRIM 98/99 To 2001- Element 6 (Process & Equipment Integrity)
% of Incidents Attributed to Element 6
100.0%
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
98/99
2000
2001
6.1 Reliability Engineering
6.2 Materials of Construction
6.3 Fabrication and Inspection Procedures
6.4 Installation Procedures
6.5 Preventative Maintenance
6.6 Process / Hardware Systems Inspection
6.7 Maint. Procedures (includes Permit to Work)
6.8 Alarm & Instrument management
6.9 Decommissioning & Demolition Procedures
PSM Element 6 - Sub-Elements

Recurring Causes of Recent Chemical Accidents

(EPA/OSHA paper)

1. Inadequate hazard review or process hazards analysis
2. Installation of pollution control equipment
3. Use of inappropriate or poorly designed equipment
4. Inadequate indications of process condition
5. Warnings went unheeded

Recurring Causes of Recent Chemical Accidents

(EPA/OSHA paper)

- Training and operator error not listed as

  "It is rarely the action or inaction of a single operator that is the sole or even primary cause of an accident"

- Operator error is normally the Least Probable Cause

Recurring Causes of Recent Chemical Accidents

(EPA/OSHA paper)

Numerous barriers must fail before operator action can cause an accident:

1. Design for minimum hazard
2. Install safety devices
3. Use safety warnings
4. Control with procedures/administrative controls
5. Personnel action by training, awareness, knowledge
6. Accepted the risk

E2 Plan Prevention Content

- A program must be in place to focus on prevention
- PSM meets the requirements, but does not need to be a stand-alone program
- Includes design, operation, maintenance, and other management systems
- Requires some degree of risk assessment and should address worse probable and other scenarios
- Should include both leading and lagging indicators
- Should focus on reducing frequency and severity through continuous improvement

Questions??