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Appendix B - Handbook of Working Environment Risk Assessment (WERA)
Appendix C - Security Manual

The handbook's appendices are available in electronic version on the Hydro intranet
1.1 Message from the CEO

Dear colleagues,
I am proud to present the second edition of HSE The Hydro Way: The handbook.

The purpose of this handbook is to provide guidance on how to carry out HSE leadership.

The handbook represents the essence of Hydro’s experiences during the last 25 years. It describes the philosophy, tools and important practices involved in making HSE an integral part of doing business. It includes a description of factors that are important to the success of HSE management and leadership at Hydro.

Hydro is a company that places great importance on care for employees and the environment. Any business in Hydro today must be run as a sustainable business. Well-run HSE leadership is also a basis for generating good results.

In the handbook, managers, safety delegates and other professionals will find tools for handling both HSE regulations, and the systematic implementation of health, security, safety and environment measures. Instructors will find help for local HSE training.

The first edition of Hydro’s HSE management handbook was published in 1997. This version replaces the earlier versions of HSE handbooks, which until now were available as four separate books: HSE management (“The green book”), Work environment Risk Assessment (WERA), Safety Analysis Risk Analysis (SARA) and Security handbook.

The current edition has retained most of the content, but has been restructured and updated. There is more focus on creating a healthy work environment, security and environmental issues, in addition to a comprehensive section on safety.

Eivind Reiten, CEO
1.2 About this handbook

This handbook collects Hydro’s HSE guidance in one document. It is aimed primarily at managers. It covers a selection of crucial and well-tested elements of HSE leadership.

The handbook is also useful for:
- The beginner, needing to understand HSE management and leadership as practiced in Hydro
- The more experienced manager in need of a reference book
- HSE specialists in need of detailed tools

An Executive Guide is available.

Central areas of “HSE the Hydro way” are:
- Secure sustained compliance
- Improve work environment conditions to minimize work-related illness
- Minimize environmental footprint
- World class level of safety performance
- Ensure security and crisis risk management

Dedicated teams:
- Our work is organized in teams in such a way that each employee develops a strong feeling of ownership to the means of production, work processes and results
- The team is responsible for defining and making visible the common goals that support the organization’s targets and for delivering results accordingly
- The team improves the work processes continuously by means of recognized methods
- The team consists of co-workers, dedicated support functions and management with the necessary competence to handle the team’s tasks and deliveries

References:
- NHC-CD04 – Health, Safety, Security and Environment
- NHC-CD03 – Hydro’s People Policy
1.3 HSE – The Hydro Way

Hydro’s HSE philosophy is outlined in chapters 1 to 3, together with background information explaining the importance of our focus on HSE management and leadership and its impact on our business performance.

Chapter 4 – “Systematic HSE Work” is directed at the manager. It focuses on risk assessment and management tools and describes the most important issues for managing each HSE element in separate sections. References to Hydro’s requirements and standards, as well as tools for implementing HSE management are also explained in this chapter.

1.4 Handbook content and structure

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The handbook is divided into six main sections.
Chapter 4.4, Basic HSE issues, contains the bulk of the practical HSE material, divided in 5 sub-sections:
- Basic issues
- Health and work environment
- Safety
- Security
- Environment

Chapter 5 focuses on compliance and follow up. Chapter 6 gives definitions of terms used in the Handbook.

HSE-handbook - Reference chapters

<table>
<thead>
<tr>
<th>Chapter 4 Systematic HSE work</th>
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<td>• Our HSE obligations</td>
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<td>• Understanding risk</td>
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<tr>
<td>• Basic issues</td>
<td>• Sector follow-up</td>
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</table>

Chapters 4 to 6 outline current requirements and practices, management practices and HSE-tools.

NAVIGATING THE CHAPTERS

Each chapter consists of text, illustrations and highlighted text blocks.

Finally, each HSE element is color coded with its own symbol for easy navigation.

Text for highlights is placed in the margins

Advice for some special hazards.

Text with especially important information related to risks and good advice.

Practical HSE-tools are marked in the left margin with this symbol.

Text explaining requirements.

References: Here you will find references.
In Hydro’s first electrochemical production plants in Telemark, “dangerous work” was already a relevant issue. Workers who reacted to gases or dust could be moved to other tasks and financial compensation was given for “particularly dirty work”.

Long-term consequences, however, were not considered, as the focus was on treating the symptoms, more than on the causes of health problems. Responsibility was placed firmly on the worker – but trade unions increasingly challenged this view.

At Hydro’s first production sites in Norway, Notodden and Rjukan, a health service and treatment room were established. At Rjukan, for example, cooperation between Hydro doctors and union representatives led to a number of initiatives and more systematic work on the causes of injury and health complaints.

HSE efforts intensified in Hydro in the 1980s after the company experienced several serious accidents, and recognized the significance of HSE as well as its relationship to productivity.

In July 1985, two persons died and one person was critically injured in an explosion at Hydro’s ammonia plant in Porsgrunn and one person was critically injured. The plant was completely destroyed. This accident was a “wake-up call” for Hydro’s management, and HSE efforts were stepped up.

Part of the focus was on the impact of our activities on the external environment. During this period, key issues were fluoride, mercury and dioxin emissions and effluents. Great focus was also directed towards our work environment and on topics that historically had severe consequences, i.e. loss of hearing and lung diseases.

Based on the philosophy that “all injuries can be prevented,” and “safety is a line responsibility,” the company aimed to halve the number of personal injuries over a three-year period from 1987. As a result, a HSE system was developed. Routines, responsibilities and reporting methods were implemented, based on quality assurance principles. Audits were used as tools for measuring the understanding of, and compliance with, the company’s HSE standards and requirements.

To publicize results, monthly reports on injuries, accidents and emissions were issued. Such reporting was undertaken at all plants, and the expression Lost Time Injury-Rate (LTI-rate or H1-value) became a standard measurement device throughout the company. New three-year plans for halving the number of injuries were made and implemented.

The LTI-rate became the Key Performance Indicator (KPI) of HSE conditions in Hydro. Later, the TRI-rate (H2-value) has taken over as our primary HSE KPI. As illustrated in the figure below, Hydro has improved its conditions considerably as a result of investments in HSE management and leadership.

Today the TRI-rate (H2-value) is our KPI.

The pronounced increase in TRI-rate around 2002 represents the status when VAW was acquired.
Following this new focus on HSE, Hydro’s top management made its position known publicly. For example, former president T. Aakvaag gave a speech at a Safety Conference in Trondheim, Norway in 1992:

“We realized that management’s full involvement was a significant success factor. It had to be understood that safety was a management responsibility; that the president was responsible to the board, division directors to the president, and so on - down to the plant foremen and operators... We experienced that the reduced frequency of accidents led to an increase in productivity and a reduction in accidental emissions. This also led to better job satisfaction and a drop in cases of sick leave. We had entered a positive cycle.”

During this phase of Hydro’s HSE improvement work, the most important element was generating motivation and enthusiasm for HSE within the organization. This remains a critical factor today.

The next phase involved working more systematically to set standards. Dangerous conditions and unsafe acts were identified and control routines established. HSE methods and results were continually communicated. Line management was made responsible for reaching Hydro’s HSE goals. HSE staff functions at different levels of the company, (in the sectors and individual production and work units) became responsible for establishing standards, goals and requirements, as well as auditing. The HSE staff also provided professional support to the line. This was an important step towards integrating HSE in business development and planning.

Our HSE focus has gradually widened to take into account relations with our suppliers, dialogue with those outside the company impacted by or interested in our operations, the work environment, security and protection of the environment. Given that Hydro uses a great deal of energy, efficiency and our carbon emissions are of particular concern.

In 2001, CEO Eivind Reiten stated:

“Sustainable behavior for me is an umbrella concept for the way we operate our company. It includes our approach to the safety of our employees, our consideration of the external environment, and the way we use our research and development resources to find solutions that will improve sustainability in the long term. It is also a question of how we communicate and interact with society and our customers, and not least how we secure the economic basis on which we can develop the company further.

Continual improvement, innovation and sustainable behavior – these are concepts that must characterize all our operations.

I want to foster these approaches in the company because I believe that this is the key to our future success”.

LESSONS LEARNT

The most important HSE lessons Hydro has learned to date are:

- The importance of leadership and management
- The need to involve everyone in the organization
- The importance of continuing to monitor that the basics are in place
- The importance of a good work environment as a basis for good HSE performance
- The recognition that the human factor (what motivates the individual) must be incorporated in all aspects of HSE management – we must ensure HSE is understood and acted upon daily
- The importance of taking care of employee health

Together, these experiences – when acted upon – have contributed to improving Hydro’s HSE performance. They have demonstrated that focus on HSE issues can also enhance production and results in our plants and units.
This chapter gives an overview of the basis for Hydro’s health and work environment, security, safety and environment (HSE) activities. It describes why HSE management and leadership is important to Hydro, why certain priorities have been set and how HSE must be integrated into our daily operations. It also examines how our HSE performance affects economic results.

We will:
Strive for a healthy workplace, safe and secure conduct and low environmental impact
2.1 Our strategic goals

**Hydro's Corporate Directive NHC-CD04 states:**
“Our ambition is to demonstrate a strong sense of responsibility for people and the environment and to be at the forefront – in terms of environmental care and industrial safety.”

Hydro’s Values, as defined in The Hydro Way, form a basis for day-to-day HSE work.

**Courage:** Facing challenges and addressing unsafe behavior

**Respect:** Acting with integrity and recognizing the inherent worth of all people, the value of the earth and the resources it provides

**Cooperation:** Working with others in an open and inclusive way. Learning and sharing lessons on HSE issues across the organization

**Determination:** Defining a goal and working to achieve the result we need

**Foresight:** Addressing potential problems before they occur and envisioning long-term opportunities and solutions

**The Hydro Way means:**
- HSE leadership is an integrated part of our business
- HSE is a line responsibility.
- Leadership and management commitment and accountability are the most important ingredients for improvements and good results to be achieved. HSE performance is also a KPI on which managers are judged.

**Our strategy:** Proactive is the priority, following our opportunities and minimizing our risks.

**Hydro policy**
Hydro’s ambition is to demonstrate courage, foresight, respect and a strong sense of responsibility for people and the environment.

**Requirements:**
Hydro wants to lead the industry with our ethical standards and run the business according to the principles of sustainability. As a leader within Hydro, it is your responsibility to contribute to these ambitions locally.

References:
Hydro’s business principles, overall goals and strategies are explained in:

- Hydro’s directives.
- NHC-CD04 – Health, Security, safety and environment (HSE)
- NHC-CD03 – Hydro’s People policy
- NHC-CD05 – Hydro’s Code of Conduct
- NHC-CD12 – Social Responsibility
2.2 Hydro ethics, social responsibility and HSE

Hydro’s principles for HSE management and leadership are based on care for our people and the environment. At Hydro, we believe that it is impossible to separate good economic performance from a good HSE record. This means Hydro’s work ethics are based on a philosophy where continuous improvement of HSE performance is essential.

Our philosophy on the links between ethical behavior, social responsibility and HSE can be summarized in the following way:

1. “Good ethics” means doing the right things in the right way. For example, as a manager you should demonstrate openness, respect and commitment. You should also encourage colleagues to come forward with solutions to HSE issues you are all facing.

2. Social responsibility means to consider the social impact of our business on employees as well as local communities where we operate. In order to increase the level of local knowledge, a social impact assessment should be conducted as part of the decision making process. Ask yourself “how will this affect the local community?”

3. As a Hydro employee you should always strive to exercise good judgement, care and consideration in your service for the company. The code of conduct provides a framework for what Hydro considers responsible conduct, but is not exhaustive.

These simple philosophies are part of Hydro’s challenge to our managers: they must be incorporated into the way we do business; all day, every day.

The Hydro culture

“The Hydro culture is rooted on openness, respect and commitment for other people. Hydro’s diversified operations demand an elevated degree of care, honesty and integrity. Accordingly, Hydro values its company, culture and reputation as key assets. We expect our employees to promote our core values by acting responsibly towards colleagues, business associates and society at large.”

To achieve a successful culture, local HSE standards must be based on clear ethical norms and Hydro values.

Social responsibility will create and maintain business opportunities, while strengthening our corporate reputation. This is a management responsibility.

References:

NHC-CD05 – Hydro’s Code of Conduct
2.3 Leading with HSE is good business

Organizations with high HSE standards are often the most successful in preventing losses, irrespective of their size or the type of industry.

In Hydro, experience shows that plants with high operational regularity have a low number of injuries and accidental emissions.

Good HSE management will also reduce economic losses.

THE HIDDEN COSTS OF ACCIDENTS.

Consider the costs due to lack of leadership as simply the tip of the iceberg; the majority are hidden below the water line. For example, HSE studies have shown that, on average, uninsured losses cost 10 times the amount paid in premiums.

Consider the costs resulting from an injured colleague being absent from work, even for a short period of time. How does this affect the rest of the team?

Accidents and ill-health are not only costly to our colleagues and their families, but they also hurt business because they entail great costs from:

- Damage to Hydro’s reputation
- Production delays
- Damage to products, plant, buildings, tools and equipment
- Investigation time
- Clearing the site and conducting repairs
- Sick-pay
- Overtime payment and temporary labor costs
- Legal costs
- Fines
- Loss of data/information/knowledge
- Loss of contracts

Some of these costs are not immediately visible.

For all these reasons, Hydro places great emphasis on improving HSE standards across the business.

Good leaders estimate the potential costs of accidents, ill health and environmental damage, compare these costs to overall operating costs or annual turnover, or the work of the additional sales needed to cover them, thus judging their significance and enabling planning for preventive measures.

HSE loss categories
- Loss of life
- Injury to people
- Disease
- Reduced quality of life
- Acute and continuous pollution
- Material damage
- Loss of production
- Loss of data/information/knowledge
This chapter describes the challenges involved in developing HSE leadership, including the kinds of basic information to be familiar with and how HSE management develops over time.

Taking the lead in HSE

To live our values we will:

- Have the courage to set ambitious goals for HSE performance
- Publicize our goals, promote transparency in our reporting and engage in cooperation with safety delegates, union representatives, local communities and non-governmental organizations (NGOs), as appropriate
HSE leadership is a challenge. As well as a good understanding of the industrial processes taking place within your area of responsibility, the manager must have a comprehensive view of hazards (see Chapter 4), remain committed over long periods, and inspire those around them to behave according to expectations.

HSE leadership in Hydro starts by successfully mastering these basics:
• Equal attention to all HSE elements
• Attention to HSE issues in all parts of the value chain:
  - Extraction and procurement of raw materials
  - Transportation and storage
  - Production
  - Handling and use of products
  - Waste disposal, reuse and recycling
  - Other activities - acquisitions, mergers, investments, divestments, closures, commercial agreements, modifications and the development of new products and processes.
• Thorough understanding of the regulatory requirements around our processes and products, risk assessment and risk control measures
• Ensuring that training needs are met and that competence on HSE issues is maintained for employees
• Security measures, such as shredding documents and supervising site visitors

As manager you must know how to lead your employees in all HSE elements within your area of responsibility:
• Health and work environment: Physical, chemical, psychosocial and organizational
• Security: personnel, process, information
• Safety: personnel, process, and technical
• Environment: environmental protection and product stewardship

You must also be fully prepared in case of an emergency.

References:
NHC-CD04 – Health, Safety, Security and Environment (HSE)
Main HSE issues

The checklist below will help you identify HSE issues that are important and may be relevant for your organization. This list is not exhaustive - local conditions must be taken into account.

### Health

| Occupational health | • Work-related illness  
|                     | • Promotion of health in the workplace  
|                     | • Occupational health care.  
|                     | • Travellers – preparation before travel, vaccinations and ongoing care while abroad, including periods of travel  
| Sick leave | • Absence due to sick leave, causes and follow up, rehabilitation.  
| Health control | • Evaluation of health status, when needed.  
| Alcohol and drugs | • Advice and rehabilitation  
|                  | • Test and control activities according to needs and legislation.  
| Liabilities | • Occupational disease  

### Work environment

| Psychosocial factors | • Fatigue and stress  
|                     | • Job satisfaction and job involvement  
|                     | • Motivation  
| Organizational factors | • Organization of work  
|                        | • Workload  
|                        | • Change management  
|                        | • Personnel policy/promotion  
|                        | • Travel  
| Physical factors | • Ergonomics  
|                  | • Noise  
|                  | • Vibration  
|                  | • Heat or cold stress  
|                  | • Radiation  
|                  | • Lighting  
|                  | • Indoor climate  
| Chemical factors | • Exposure to hazardous chemicals through inhalation, skin contact or swallowing  
| Biological factors | • Microorganisms that can cause infections, allergy or intoxication  
|                        | • Drinking water  
|                        | • Personal hygiene  

### Local conditions

The checklist below will help you identify HSE issues that are important and may be relevant for your organization. This list is not exhaustive - local conditions must be taken into account.
### Safety

<table>
<thead>
<tr>
<th>Subcategory</th>
<th>Hazards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical hazards</td>
<td>• Cuts • Falls • Falling loads • Squeezes/crushing • Moving/flying objects • Collisions</td>
</tr>
<tr>
<td>Thermal hazards</td>
<td>• Hot surfaces • Hot/cold fluids and gases • Steam</td>
</tr>
<tr>
<td>Electrical hazards</td>
<td>• High/low voltage</td>
</tr>
<tr>
<td>Chemical hazards</td>
<td>• Hazardous atmosphere (toxic gases, suffocative gases, air with low oxygen content) • Flammable, explosive, corrosive and reactive materials</td>
</tr>
<tr>
<td>Transportation/traffic</td>
<td>• Transportation of dangerous goods • Internal transportation • Driving externally</td>
</tr>
</tbody>
</table>

### Security

<table>
<thead>
<tr>
<th>Subcategory</th>
<th>Hazards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical security</td>
<td>• Protected, controlled, sensitive and critical areas of Hydro plants</td>
</tr>
<tr>
<td></td>
<td>• Industrial espionage • Sabotage and terrorism</td>
</tr>
<tr>
<td>Personnel security</td>
<td>• Hiring processes • Employee's own security responsibilities (access cards, passwords, accompanying visitors) • Threats and blackmail</td>
</tr>
<tr>
<td>Travel security</td>
<td>• Traveller and expatriate security in high risk areas</td>
</tr>
<tr>
<td>Information security</td>
<td>• Information assets protected from potential loss, damage, destruction or theft</td>
</tr>
</tbody>
</table>

### Environment

<table>
<thead>
<tr>
<th>Subcategory</th>
<th>Hazards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural resources - Biodiversity</td>
<td>• Use of energy, raw materials, freshwater and land</td>
</tr>
<tr>
<td>Emissions/discharges</td>
<td>• Emissions to air/atmosphere, including climate change issues • Discharges to water and soil/ground</td>
</tr>
<tr>
<td>Waste generation</td>
<td>• Incineration, depositing, reuse/recycling</td>
</tr>
<tr>
<td>Liabilities</td>
<td>• Soil, groundwater, sediments</td>
</tr>
<tr>
<td>Local conditions</td>
<td>• Follow up of permits and local stakeholders</td>
</tr>
</tbody>
</table>
3.1 Development of HSE leadership

IMPLEMENTING HSE IMPROVEMENTS
STEP BY STEP

Excellent HSE leadership cannot be achieved overnight. The process must be continuous.

Any manager who is about to head the implementation and development of an HSE system must demonstrate ownership of the process, in addition to personal commitment to improve HSE standards.

When starting from scratch, it will usually take five years or more before a consistent improvement is achieved. When a HSE KPI, such as TRI value, is measured, you will see that improvements stop at a certain point. This is natural. It means that you as managers have reached the next phase and need to use new tools and new motivation to continue improvements, alongside keeping up doing what you did to get there.

From the outset, the HSE improvement process should focus on creating a team philosophy – everyone is responsible for working together to ensure safe, secure, healthy and environmentally conscious behavior.

The three phases of developing HSE leadership are:

- Management commitment
- Personal commitment
- Team commitment

Characteristics of the three phases are described on the following pages.

Ask yourself:

- Do I sincerely want changes
- Am I convinced that this is important for my business?
- Do I really want to commit myself
Management commitment phase – Roles and activities

**Phase 1 – Management commitment**
- **change of mindset**
  All managers have to commit to a new way of thinking: HSE is the most important operating factor.

A good HSE level is the basic foundation for operations; our “license to operate”. Working in a plant shall not cause ill health or injuries.

Managers will first need to gain an overview of the current status of HSE work in their area of responsibility. Targets and goals for each HSE element (work environment, security, safety and environment) should then be put in place. Decisions must be made and Chapter 4 gives further guidance on this.

In this phase, managers must establish a common HSE culture.

**Remember the three T’s:**
- **Things**
- **Take**
- **Time**

<table>
<thead>
<tr>
<th>Management commitment phase – Roles and activities</th>
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</thead>
<tbody>
<tr>
<td><strong>Manager</strong></td>
<td><strong>Employee</strong></td>
</tr>
<tr>
<td>Controlling management style</td>
<td>The business is management-oriented</td>
</tr>
<tr>
<td>Personal commitment – show you care</td>
<td>Regulations control my workday</td>
</tr>
<tr>
<td>Introduce HSE tools</td>
<td>Rewards and discipline govern behavior</td>
</tr>
<tr>
<td>Establish standards</td>
<td>Procedures are enforced consistently</td>
</tr>
</tbody>
</table>

**Tools**
- Analysis of current HSE status and action plans
- Information and HSE meetings
- Housekeeping
- Setting standards, i.e. correct use of personal safety equipment at all times
- Employee involvement and training
- WOC (walk, observe, communicate) routines
- Reporting accidents
- Measuring and publicizing TRI-rate
- Written work permits
- Risk assessments

You cannot rush the work, but must allow time for acceptance of new regulations and practices.

If done correctly, considerable improvements will have been achieved after just a year or two.
Phase 2 - Personal commitment
At this stage, employees have realized the benefits of HSE work and will put in more effort. Phase two involves consolidating the organization. Further HSE activities and systems can be implemented.

Managers now need to communicate the new HSE standard, how it will affect the organization and why it is important.

Personal commitment phase – Roles and activities

<table>
<thead>
<tr>
<th>Manager</th>
<th>Employee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduce standard for behavior</td>
<td>Personal Commitment</td>
</tr>
<tr>
<td>Recognize and reward individual behavior</td>
<td>Be your own HSE manager</td>
</tr>
<tr>
<td>Feed the process</td>
<td>HSE competence</td>
</tr>
<tr>
<td>Handle deviations</td>
<td>Plant values are understood</td>
</tr>
<tr>
<td>Be a driving force</td>
<td>Adapt to common values</td>
</tr>
<tr>
<td></td>
<td>Increased responsibility</td>
</tr>
</tbody>
</table>

Tools
- Written work permits if not implemented already (mandatory)
- Use of Safe Job Analysis (SJA)
- Comprehensive use of risk assessment tools
- Reporting of near misses
- Measuring and publicizing TRI rate
- Audits
- Energy control
- Active use of PDCA (Plan, Do, Check, Act) as an improvement tool
- Risk assessments

In this phase, the speed of the improvement process normally slows down. To achieve continued progress, management has to maintain a strong HSE focus.
When working with a new organization, it is normally best to begin at the management commitment phase. If you are new to a job with experienced employees and an established HSE culture, you should learn from their achievements and build upon them, rather than imposing new systems.

In the team commitment phase, you establish the HSE level that you intend to keep as “normal”. Maintaining this will require leadership commitment and the continuous involvement of employees.

### What characterizes a good culture?

**A learning organization:** The organization has a “pull” for know how and good practice, the ability to understand HSE problems, causes and solutions, and has the will and motivation to implement changes when and where needed.

**Flexibility:** The organization adapts efficiently to changing demands, and is able to adjust quickly to different circumstances.

**Transparency:** The organization has an atmosphere of trust. People are encouraged to be open with regard to HSE related information. It is clear to everyone what kind of behavior is acceptable.

**Reporting:** Employees practice openness, and inform each other about mistakes and near misses.

**Perception of fairness:** The organization recognizes that collective rules are directed at a common goal, and enforced for everyone.

### What ensures a performance culture?

A manager must be personally involved in HSE when leading others. To succeed, work is required on the five elements below:

**Insight**

Employees have different needs, desires, motivations, fears, cultural backgrounds and experiences.

**Motivation**

Providing direction, motivating and inspiring others is extremely important. It involves communicating directly and regularly with employees.

When working with a new organization, it is normally best to begin at the management commitment phase.

If you are new to a job with experienced employees and an established HSE culture, you should learn from their achievements and build upon them, rather than imposing new systems.

### Remember:

Whatever managers focus upon will become the dominant culture or HSE priority.

Building a positive, comprehensive HSE culture is a continuous process that takes time.
Focus
Communication: Remember that actions speak louder than words – a leader must do more than simply express the importance of safety. A manager must be active and visible in daily HSE work and follow all applicable rules and procedures.

Sincerity
A leader must actively care about employee safety and well-being. Good HSE results cannot be achieved if employees do not believe their leader cares or is sincere.

Responsibilities
Leaders must provide clear responsibilities for assigned duties and tasks, and communicate expectations to all employees.

HSE leadership in practice is a dialogue between the manager and his/her employees. To achieve the highest HSE standards, managers must build team commitment with a high level of involvement from the whole organization.

Leaders involve the rest of the organization, e.g. safety delegate and shift leaders. This ensures practical solutions where HSE elements are thoroughly evaluated and well founded.

There are several groups within Hydro that can offer managers support and advice for achieving good HSE results:

- All employees – they do the job
- Safety delegates – important points of contact
- Shift leaders – good knowledge of existing problems and employee concerns, important points of contact
- Local HSE personnel – experts who coordinate and follow up
- HSE committee – forum for collaboration
- Health personnel – OHS
- Human Resources – administrative body
- Corporate HSE and Corporate Communications – share ideas and expertise

Leadership and commitment
- The leader motivates and engages by systematically involving his co-workers in goal development, problem solving and improvement work in accordance with AMPS (Aluminium Metal Production System)
- The leader helps his team to find good, balanced solutions by asking challenging questions and encouraging an open and active dialogue
- The leader gives constructive feedback, and regular recognition for good results, while dealing with weak performance in a proactive, fair and efficient manner
- The leader demonstrates clear leadership by maintaining a high visibility, by involving himself actively with his employees, and by always setting a good example

Note:
Motivate employees to take responsibility and exercise influence

Examples of tools.
Leadership, commitment and accountability. Building a good culture

In this section, the different elements that go into HSE leadership and building a good HSE culture are outlined.

Leadership abilities are important for achieving HSE goals. Failure to provide good leadership will undermine the credibility of the HSE policy, objectives and targets.

On the other hand, good leadership will:
- Protect employees and resources
- Establish a foundation of trust and credibility
- Promote a positive performance culture
- Increase efficiency in operations, quality and costs
- Contribute to reaching KPIs
- Ensure that employees and suppliers understand their responsibilities

THE MANAGER’S HSE ROLES AND RESPONSIBILITIES

Communicate and be a good example.

Important activities are:
- Establish HSE targets and action plans for the unit
- Collect HSE information relevant for the plant or process (what hazards are present at the site?)
- Implement and keep control of regulatory requirements (national/local legislation)
- Enforce work standards and practices
- Follow up incorrect behavior
- Contribute to good HSE levels in design and modifications
- Implement HSE training for the organization
- Manage emergency preparedness
- Follow up HSE standards for contractors

When communicating HSE standards and practices, do not forget to practice them yourself – “Walk the talk”.

However, a clear understanding of your role and responsibilities for HSE is not enough to ensure lasting change. Good HSE KPI levels result from a performance culture. This has to be created through good leadership, good communication and an understanding of human and organizational factors.

“Managers shall show determination and commitment to HSE through active leadership, i.e. drive the continuous improvement process: set goals, follow up and support HSE activities, and build a sustainable HSE culture”.

How to practice good HSE leadership.

- Take the initiative for HSE activities
- Personally communicate HSE issues
- Explain what you would like to see more of
- Do things - don’t just talk about them
- Comply with all HSE rules, including safe and defensive driving
- Use required safety equipment and other equipment as necessary
- Participate in daily HSE work, such as safety rounds, audits, investigations, training
- React when you see others breaking rules or engage in dangerous practices
- Praise those who display “ownership” of the HSE process
Human factors

Human factors are environmental, organizational and job factors, as well as individual qualities, that influence behavior at work and can affect health and safety.

The goal is to create a work situation where safe and effective operations are “normal”. Active use must be made of the employees’ individual strengths, needs and limitations.

We stress again: involving employees is a key element to success in HSE management.

The interaction between employees, facilities and organization is influenced by:
• The work environment
• The culture of the organization

HOW CAN YOU UNDERSTAND YOUR ORGANIZATION’S CULTURE?

The simplest way is to discuss it with your colleagues!

A more thorough evaluation should include one or more of these methods:
• Interviews
• Observation
• Analysis of the content of written documents and questionnaires

Other available HSE data can also be used, e.g. employee satisfaction surveys, or data from reported incidents.

WHAT BUILDS A POSITIVE CULTURE?

Creating values, norms and attitudes takes time, but continuous leadership commitment and accountability will lead to changes in thinking, beliefs and behavior.

Culture is the knowledge, values, norms, ideas and attitudes that characterize a group of people - it is “the way we do things around here”.

A good culture is characterized by consistency between what people do and what they say.

The coordination of management, people and equipment creates the optimal work situation.
Communicating HSE

Open communication within the organization is a prerequisite to ensure that all employees have the appropriate level of understanding of procedures and HSE goals.

Knowledge of the plant and processes, having the necessary tools and ability to create dialogue are required in order to control HSE standards.

To ensure that employees respect and adhere to a given HSE standard, a learning organization is required. It is important to:

• Explain the standard
• Listen to employees in order to identify challenges and proposals for improvement
• Agree on how to implement the new standard
• Ask questions to check that the standard and the behavior needed to achieve it are fully understood

The key word is “dialogue”. An open dialogue needs to be established and maintained.

This can be done through formal meetings and reporting or informally, e.g., at the beginning of shifts. It can also be done by spending time in the plant. The most widely used tool for HSE communication is the WOC.

**WOC**
WOC (Walk, Observe, Communicate) provides the opportunity for managerial interaction with personnel and enables managers to demonstrate attitudes and preferences.

WOC is a systematic management “tour” of the plant/premises to look at and discuss/communicate HSE issues. Discussions should cover behavior, practice, and culture.

The goal of a WOC is to:
• Evaluate HSE behavior
• Communicate with employees
• Initiate improvements

To maintain and improve local HSE standards and performance, WOC rounds are carried out in the following way:

• Normally two people participate in each WOC.
• The manager, accompanied by a subordinate manager or colleague, walks around the plant, observes behavior and talks with operators. WOC should be carried out once every two weeks, rotating the areas covered and the subordinates involved.
• The next organizational level will walk with their colleagues in turn, and the principle is followed down to foremen / first line level.

In this way, managers can personally follow up HSE practice in the real work environment and ensure that the right culture is developing.

Remember: HSE standards for employees need first to be demonstrated consistently by managers.

**Behavior-Based Safety**
Behavior-Based Safety (BBS) has been introduced in Hydro. This tool is supplementary to WOC, involving employees in defining behavior standards. Behavior-Based Safety is a pro-active tool for accident prevention, aimed at avoiding undesirable behavior. Changes in behavior result in a reduction in the probability of accidents.

The main philosophy is to observe a person’s behavior in a work situation and then initiate dialogue about it. Good behavior is praised, and unwanted behavior is highlighted and corrected.

The tool consists of four main elements:
• Recognize what kind of behavior produces risks, and what is safe/healthy
• Observe how operations are carried out
• Give feedback to each person
• Use all available information to remove obstacles that prevent safe/healthy

Using the Behavior-Based Safety tool requires a culture of openness, where commenting on the behavior of colleagues is permitted and encouraged. However, the focus must be on improvement, not punishment.

**HSE attitude**
Be knowledgeable about the operation / process. You should have insights into the activities for which you are responsible to understand the potential risks that lie ahead

Look into available background information
Evaluate risks
Check job procedures, certifications, permits
Check safety arrangements

**10 steps for conducting a WOC**
• Schedule the WOC (include all HSE-elements)
• Stop & observe people
• Put people at ease
• Ask what and how the worst accident could happen
• Point out observations of unsafe conditions and acts
• Discuss ways to organize and do the job more safely
• Ask what corrective action is required
• Get commitment to act
• Document the WOC
• Follow up

“The Organization shall make sure that all employees have appropriate competence, are familiar with the HSE challenges, impacts/hazards and risks of their activities and tasks, and instructions necessary for correct behavior and performance.”

References:
NHS-CD04-01- HSE Management system
This chapter presents tools and techniques for developing and carrying out an effective health, safety, security and environment (HSE) strategy. A Tool Box summarizing general risk assessment tools and more specialized tools has been provided for easy reference.

To live our values we will:
Through foresight, strive to prevent injuries on our premises and avoid work-related illnesses, production loss or damage to the environment.
4.1 Our HSE obligations

Our HSE-standards, the Steering Documents have been made available on the Hydro intranet, along with legal requirements. These are mandatory.

In addition to Corporate documents, you must know steering documents at Business Area level/ Sector/local documents. The majority of these documents can be found in the process databases that describe best practices for operations.

If requirements are described locally, it is not necessary to know details at a higher level.

Managers need to have routines for handling communication with suppliers, customers, authorities and the local community on HSE issues.

Records of discharges and waste from the facility’s activities, including environmental impact, must be established and maintained permanently. This includes records for any premises acquired or closed/sold.

Finally, employee exposure to work environment factors, which may represent either a short or long-term health hazard, must also be recorded and updated regularly and kept for as long as is required in your country (min. 40 years required in EU, 60 in Norway).

HOW TO NAVIGATE OUR HSE REQUIREMENTS

It is important to be systematic so that no element is overlooked.

A few tips:

Ensure all HSE requirements are known by, and easily available to, those who need them or find them useful for their responsibilities. Managers will need to set up a system for doing this. This system must also ensure information is passed up and downwards in the hierarchy so that employees are updated regularly on new legislative and internal requirements. A good way to do this is to make HSE a topic at regular meetings of employees, perhaps once a month.

Remember that compliance with agreements, standards or guidelines issued by industry associations or other organizations is based on voluntary decisions made by the various Sectors or Business Units in Hydro.

Don’t leave it to chance that “somebody” will see to it that new responsibilities are clearly communicated and followed up. It is dangerous and unfair to believe that your colleagues will be able to work out for themselves which rules apply to their areas of responsibility. Those who need to know the rules must know the rules. Ensuring this happens is a line responsibility.

Respect our enforcement process and know what is expected of you. Corporate HSE staff will conduct audits to check that all requirements are adhered to at Sector Level. The Sectors then audit lower organizational levels to check that they also abide by applicable rules and requirements. See Chapter 5 for more details.

Hydro’s Corporate Steering Documents are structured as follows:

- **Policy**: Defines our philosophies
- **Directives**: Define principles and overall strategic goals on issues of critical importance to Hydro
- **Procedures**: Define means and methods to attain our goals
- **Standards**: Provide methods for actions related to our goals
- **Best Practices**: Detailed descriptions of work processes

All up-to-date Hydro Directives, Procedures and Standards can be found on our intranet.

Manager’s responsibilities

“Managers at all levels shall address all relevant HSE issues. They are accountable for the HSE performance of their operations/activities, including an appropriate level of security, and for compliance with statutory requirements and Hydro’s corporate steering documents” (NHC-CD04).

“The Organization shall make sure that the operational units have established and maintain easy access to regulatory requirements” (NHC-CD04-01).

Remember:

You cannot control what you do not measure, and you cannot improve what you do not control.

This means:

To improve something, you have to control it, and to control it you have to measure it.

The HSE document hierarchy.
Please refer to the HSE intranet site for the latest versions of these important documents.
COMPETENCE AND TRAINING

Assessments of competence must take place regularly for all employees to have an up-to-date understanding of the hazards they are facing and the measures needed to reduce the risk of accidents and injury.

The basic process for HSE training is:

1. Determine the competence level by analyzing requirements both for the Unit as a whole, and for each individual employee
2. Provide and plan necessary training activities to fill competence gaps
3. Evaluate the effectiveness of the training, and fill remaining gaps

When planning training, managers must establish which HSE aspects are relevant to the specific organization or plant. This means training might focus on regulations and requirements, procedures and work instructions, risk potentials, security issues, emergency preparedness or best practice techniques according to local circumstances and needs.

HSE staff can give advice on available training modules and help you assess specific training needs within your organization.

Hydro emphasizes the need for competence management:

"The Organization shall identify competence requirements and needs, including training, to meet their targets"

A manager is obliged to ensure that all parties within the organization have the required level of HSE competence. This includes preparing and implementing the HSE training of all employees.

Separate training programs have to be implemented for management, safety delegates and for contractors and hired workers. Training activities, as well as education, skills and experience, must be documented.

The main categories of training are:

“On the job training” under supervision of an experienced co-worker (recommended for effective learning)
Regular training courses
"HSE e-learning", offered on the Hydro Intranet

Competence = Ability + Willingness + Opportunity

References:
HSE-CD-04-01 – Hydro HSE management system
Hydro's People Policy
4.2 Understanding Risk

The difference between “hazard” and “risk”.

Hazard = a potential source of harm.

For example, within Hydro, hazards include:
- Noise
- Chemical
- Heat stress
- Ergonomics
- Lifting equipment
- Machinery
- Information leaks
- Travel

Risk is the quantified relationship between hazard and the consequences on people, the environment or equipment. Put another way:

**Risk = probability x negative consequences (in the case of acute events)**

Or, for risks related to normally occurring emissions or exposure;

**Risk = the relationship between exposure and a health or environmental hazard**

**Hydro’s Risk-Based Management**

Risk-Based Management (RBM) is Hydro’s HSE management principle. It is applied systematically to assess risk levels and establish acceptance criteria.

Risk-Based Management assessments provide a basis for prioritizing risk reducing measures.

When considering risk-reducing measures, it is important to apply cost/benefit analyses in order to evaluate different options.

Risk Based Management is illustrated in figure 4.2. The process applies to all HSE elements: safety, environmental, security and health.

**Hydro policy:**

We will strive for a healthy work place, safe and secure conduct and a low environmental impact.

Recommended quantitative risk acceptance criteria (probability of loss of life per year; as an individual risk, not average):
- Risk exposed personnel: $10^{-3}$
- Control rooms, etc.: $10^{-4}$
- Off site: $10^{-5}$

“The Organization shall assess risks related to chemical, physical, social, human, criminal and organizational factors, which may represent a hazard to human health and environment, both in the short and long term. Physical security levels shall be determined, based upon the risk assessment.”

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References:
NHC-CD-04-01 Hydro HSE management system
NHC-CD10 Risk management
**RISK ASSESSMENT**

One of the most important HSE tasks for Hydro managers is to fully understand all the hazards present in their organization. Once these hazards have been listed, each can be risk assessed so that risk reduction measures are put in place.

*By “all hazards” we mean:*

- Hazards in the work environment impacting health (chemical exposure, noise, ergonomics - short and long term effects)
- Safety hazards (potential accidents caused by employees or 3rd parties)
- Security hazards (access to Hydro property, industrial espionage, information leaks)
- Environmental hazards (short and long term effects, local and global)

**Risk assessment consists of four main phases:**

- The choice of suitable methods for analyzing risks
- Performing the analysis
- Evaluating the results
- Implementing measures to achieve acceptable risks

According to the principle of continuous improvement, further risk reduction measures should always be implemented if the cost is low relative to the reduction in the risk level that is achieved. Costly risk reduction measures that have little benefit should be avoided. This principle is known as the ALARP principle (As Low As Reasonably Practicable). The results stemming from risk analyses are used to identify competence needs, to prepare objectives, and to define performance indicators, targets and yearly action plans.

The following sections outline different methods for assessing the different kinds of risk levels posed by hazards found within Hydro operations. It is important to know where and when risks are high and/or the HSE-results are bad, in order to determine comprehensive risk-reducing measures. More details can be found in the Appendices of this Handbook.

Managers are required to identify all hazards in plants/installations, offices… in the whole life cycle from feasibility study, through operation (including modification activities) to demolishing. These hazards shall be subject to risk assessment.

Risk management shall be an integral part of all business activities, and is the responsibility of managers at all levels.

Risk assessment identifies levels of risk for all unwanted incidents, and defines preventive or corrective improvement measures in order to reduce the risk to acceptable levels.

**Example of some accidents and incidents placed in a risk matrix used for risk assessments.**

<table>
<thead>
<tr>
<th>Consequence / hazard</th>
<th>Probability / exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage leak to bund system</td>
<td>Low</td>
</tr>
<tr>
<td>Odour nuisance in neighbourhood</td>
<td>Low</td>
</tr>
<tr>
<td>Strain injury</td>
<td>High</td>
</tr>
<tr>
<td>Serious squeeze/cut injuries (e.g. eith cranes)</td>
<td>High</td>
</tr>
<tr>
<td>Exposure to carcinogenic substance</td>
<td>High</td>
</tr>
<tr>
<td>- Explosion in reactor</td>
<td></td>
</tr>
<tr>
<td>- Pollution of ground water</td>
<td></td>
</tr>
</tbody>
</table>

References:
NHC-CD04-01 - Hydro HSE management system
NHC-CD10 – Physical/personnel security
The two most useful risk assessment tools for operations are outlined below:

**Safe Job Analysis (SJA)**

SJA is a detailed examination of specific work operations.

SJA is one of the most useful tools in daily operations to prevent incidents and accidents.

A standard SJA is performed in four steps:
1. Identify job activities, or groups of activities, and for each of these
2. Identify hazards
3. Evaluate the risk (consequence and probability of hazards)
4. Suggest preventive actions

SJA is commonly used, and often required, in operations and maintenance; either for new jobs or for jobs deviating from standard operation. The results are specifications for safety measures to include when performing the job.

Remember the following points when carrying out a SJA:
- For a simple job, two people should evaluate possible risks – “What can happen, and how can we prevent it?”
- For a more complex job, several people must sit down together and make a systematic review of possible risks.

SJA must be documented and recorded.

**Rapid Risk Ranking**

Rapid Risk Ranking (RRR) is a risk evaluation technique that produces an overview of the analyzed object or task’s risks and provides prioritized actions.

The RRR method is easy to perform, and is executed in four steps:
1. Divide the object or task in sub parts
2. Identify hazards
3. Evaluate the risk (consequence and probability).
4. If high or moderate risk is found, suggest preventative actions

RRR is adaptable to any kind of task or object and every aspect of HSE risk and should be regarded as mandatory in every organization in Hydro.

In a project, RRR will be the first method of analysis, and if necessary is followed up by other methods of risk assessment.

**You can use Safe Job Analysis (SJA) to:**
- Prepare for a new job that has possible HSE-risks
- Make a safe routine for a job that is performed regularly

**You can use Rapid Risk Ranking to:**
- Prepare an overview of existing risks and measures in your plant
- Prioritize areas and remedial actions in design or business planning process

It is mandatory for all Hydro operating plants to have an updated Rapid Risk Ranking report, including documentation showing the status of risk-prevention measures.

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**Safe Job Analysis (SJA)**

<table>
<thead>
<tr>
<th>Step / activity</th>
<th>Hazards</th>
<th>Unwanted events</th>
<th>Preventive actions</th>
<th>Responsible</th>
<th>Deadline</th>
</tr>
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**Important phone numbers:** (Emergency, Executer, Safety ombud, Owner, Project manager, HSE personnel)

**References:**
- CD04-1-HSE-13 Work permits
Critical task analysis

Basic principle
Critical Task Analysis (CTA) is a systematic method for identification of the critical tasks in an analysis object. The analysis object can for example be a plant, a platform, a workshop, a store, a lab or a section of such. A general description of CTA is found in [Systematisk Kvalitet og Sikkerhet, 1998].

All tasks performed related to the analysis object are identified. The tasks may be divided into jobs. For each task, hazards and potential incidents (events) are identified by the analysis team in a group session.

For each task, the task frequency and the number of people involved are recorded. For each identified event, probability and consequences are estimated by choosing one of five categories. This is done by the analysis team in a group session.

Risk (or criticality) is calculated by a formula involving frequency, number of people, probability and consequences. This is used to classify each event as high, medium or low.

The results, i.e. the events of high and medium criticality, are summarized. High criticality events require action or further analysis. Medium criticality events require cost/benefit evaluation. If part of scope

The analysis team can identify remedial actions and evaluate the resulting risk, or this can be performed separately.

If part of scope

Define scope of analysis, i.e. analysis object, aspects to include, restrictions on time and resources etc.

Identify hazard

Estimate probability / frequency

Estimate consequences

Summarize the above to risk estimation

Evaluate risk, compare with acceptance criteria

Identify remedial actions
RISK REDUCTION: BARRIERS

A barrier is a function or a measure to stop an unwanted hazard or accident situation from developing.

HSE barriers are crucially important. Designing them, putting them in place and ensuring they are not damaged or removed is a central part of your HSE responsibilities.

A plant should always be designed to minimize hazards. There will almost always be some risk that needs to be reduced, even if plants are well designed.

A barrier can be

Natural: i.e. distance in time or space, a remote operation

Human knowledge

Technical:
- Passive: containment, walls, dikes, Protective Personal Equipment (PPE)
- Active: fire doors, automatic shut off valves, relief valves

Human actions and routines in operation:
manual monitoring, manual shut down

Administrative: training, checklists, work permit systems, warnings, procedures and standards

And when those barriers do not suffice, Emergency response: fire fighting, transfer of hazardous material, cooling

Physical and technical barriers are generally introduced during design or modifications (see pg xxx), whereas human actions and routine, administrative, and emergency response barriers are managed during operations.

Each barrier prevents hazards from becoming accidents in its own unique way. Several barriers provide better protection than one. (J. Reason 1997)

1. Human knowledge
2. Human actions and routines in operation
3. Administrative barriers
4. Technical barriers

Hydro policy:
We will ensure continuous improvement for all our activities.

HSE management in operations is mainly a matter of keeping barriers intact, whether they are human, physical, technical or administrative.
4.3 Implementing HSE

HSE leadership in Hydro is continuous, based on the “Plan, Do, Check, Act” cycle for planning and performance.

**PDCA: PLAN, DO, CHECK, ACT**

The PDCA cycle visualizes the HSE process through Plan, Do, Check and Act phases to achieve and standardize the desired standards of behavior within Hydro. All activities in the cycle are equally important.

Managers are responsible for integration of applicable HSE practices into the business processes for which they are responsible and shall show determination and commitment to HSE through active leadership, i.e. driving the continuous improvement process: set goals, follow up and support the HSE activities, and build a sustainable culture.
PLAN

Careful planning is essential to obtain good HSE performance.

Before planning improvements to HSE standards, managers must understand the current HSE status in their organization.

This may be achieved by carrying out a risk assessment, with a review of all activities and buildings/machines in each operation.

The risk assessment may be supplemented by interviews with key personnel in order to gain knowledge about existing routines and culture.

Once the status of culture and performance is established, planning may proceed.

Planning is normally divided into thee main steps:

- Assess the current situation.
- Define the desired situation.
- Identify method for reaching the goal. This means:
  - Development of goals and strategies.
  - Break down the goals into sub-goals (targets).
  - Describe detailed methods and actions.

Examples of HSE targets set within Hydro are:

- Reduce the number of TRIs on a construction site from 20 to 10 every month within 12 months
- Increase the number of HSE improvement suggestions in the maintenance department from 100 to 150 in 12 months
- Increase employee satisfaction rate from the current figure of 60 to 70 in the next biannual survey

These are all reactive KPIs. We are working hard in our improvement work to establish proactive KPIs like the WERA-KPI and T-rate.

The manager must then transform HSE targets into measuring methods (Key Performance Indicators or KPIs) to be included in local business plans. Actions, responsibilities and time limits must be specified within the KPIs.

By establishing specific actions and ensuring regular follow up, HSE targets should remain on track.

HSE Key Performance Indicators should measure elements that are controllable within specific work processes. Indicators that are influenced mainly by conditions outside the specific work processes in question should be avoided.

Examples of HSE KPIs are:

- Percentage of sick leave
- Number of fatalities
- Number of lost time injuries
- Number of total recordable accidents
- Emissions of “green house gases” in tonnes
- Waste in tonnes

The goals must not interfere with other goals in the organization

SMART

HSE goals should be characterized as being:

- **Specific**: The goal must be specific, attainable, and easily understood
- **Measurable**: The goal must be expressed in a way it can be quantified and/or evaluated
- **Ambitious**: The goal should take us a step forward
- **Realistic**: The goal must be accepted. If there are reasons to believe that the people involved will not accept a goal, the wording should be modified and the goal clarified before it is decided upon
- **Time limited**: There should always be a time frame for when the goal is to be reached
DO

Improving the HSE level normally starts with the business plan, which describes the necessary actions in detail.

It is not just a matter of deciding what to do. Experience shows that HSE performance is very closely linked to the organizational culture. Challenges related to organizational development need to be considered. Endurance, taking a long-term perspective, management commitment, and employee involvement and empowerment, are all essential elements.

Communication is an essential element. Make it clear what is going on, and what the goals are.

Make sure that you also have allocated enough resources to carry out what you have planned for.

Follow the communicated plan. Change it if necessary, but remember to communicate any changes.

The manager must demonstrate strong commitment and involve all employees in order to ensure active participation.

CHECK

When the following have been completed:

- HSE-goals and targets identified
- HSE action plans set up
- Items included in budget
- Specific jobs and tasks assigned
- Jobs started

The results need to be checked. If the HSE targets involve behavior or organizational culture change, then follow-up work must take place from the start. This can be achieved by:

- Making necessary assessments
- Planning for regular, good quality WOC rounds
- Communicating with employees – praise what you want to see more of
- Putting HSE on all meeting agendas
- Enforcing the use of Personal Protective Equipment (PPE)
- Performing HSE inspections
- Using audits to assess status
- Presenting the results of KPI measurements in formal meetings with employees

Facts and data are required to verify HSE progress. It is unrealistic to expect improvements to occur without supervision. By constantly being aware of how planned activities are proceeding, managers remain in control and corrections can be made.

“Walk, Observe, Communicate” (WOC) can be a very useful tool for improving the HSE culture and for changing practices in your organization. See page 28.

Remember:

“To do what is agreed”. Actions that are planned must be carried out, if the leader is to maintain credibility.

Key elements of success:

- Recognition and communication of the importance of change
- Training of all employees, starting with the upper management levels
- Change of leadership roles and management behavior
- Follow-up of plans and results throughout all levels of the organization
ACT

Once new measures have been carried out, it is time to evaluate if the goal/target has been achieved and, if so, to ask the following questions:

What contributed most to reaching the target?

- Who participated?
- Can this be repeated?
- How can the method used be standardized?
- How can the results be communicated?
- Is any training required?

If the target has not been reached, the following questions should be asked:

- Was there a single cause? Or many causes?
- What did not go according to plan?
- Was it the right target?
- What needs to be changed?

The information from evaluating results may be used to:

- Improve measures
- Improve processes
- Improve competence
- Adjust goals
WHEN HSE GOALS ARE NOT MET

The following processes and tools should be used to evaluate why results do not match the HSE goals set. They can help put in place new plans and goals.

Improved HSE performance should be based on defined HSE and operational standards, combined with systematic analysis, follow up work and correction of deviations from the standard.

Getting Started: Standardize Critical Processes
All HSE requirements and critical work processes should be described and standardized (followed by everybody, every time).

Specific HSE requirements and safe operations should be included in standard practice. Best Practice should be implemented when relevant.

Standard practice should describe both the work processes and expected outcomes from the work processes. Depending on the nature of the work processes, this should also include how to measure (technical elements) and/or observe (behavior) to make sure that the standard is being followed correctly.

Various tools for monitoring and improving HSE performance are available:

- Technical measurements and observations in the workplace
- Walk, Observe, Communicate rounds (WOC)
- Operators observing each other (Behavior Based Safety)
- Accident, near miss and incident reporting
- Performance monitoring:
  TRI-rate,
  T-rate,
  WERA (Work environment risk assessment) -KPI,
  Environment: E-KPI
- HSE audits

It is important that measured and/or observed deviations from HSE standards and standard practice are immediately addressed and corrected.

Temporary corrective actions should be evaluated if it will take time to implement permanent solutions.

Analyze deviations and identify root causes
Deviations in measured and/or observed HSE performance should be thoroughly analyzed. This can help identify systematic, recurring problems, identify their causes and help design corrective action.
Several tools exist for finding causes for deviations

The most common are:
• Root cause analysis (or the 5 Whys)
• Cause and effect analysis (focusing on equipment, processes, methods, materials, people and systems)
• Statistical tools such as Pareto diagrams, Gantt diagrams, control diagrams, histograms and tree diagrams

It is important to combine statistical and practical knowledge when analyzing deviations. Ideally operators who do the job themselves should carry out analyses of this kind.

Root Cause analysis
This form of analysis, also called “the 5 whys method”, is often used to determine the possible causes of a problem or an incident. By asking, “what went wrong?” and then “why?” to each of the five subsequent answers, it is often possible to uncover the root of recurring problems. Note that five is a guideline number. What is important is to get to the root of the problem.

For example: “What went wrong?” “Lockout was not followed correctly”, “Why?”, “To make the job quicker to finish”, “Why?”, “To be able to follow the production plan”.

Cause–and-Effect diagram
This tool is another form of root cause analysis. It is also referred to as a Fishbone diagram or an Ishikawa diagram.

The Cause-and-Effect analysis is used to identify and classify the root causes of a problem into five categories; equipment, processes, methods, materials, people and systems.

This form of analysis will help users focus systematically on different elements within the work process, in order to find specific solutions.

Example of Ishikawa diagram for cause and effect analysis.

![Ishikawa Diagram](image-url)
**Pareto analysis**

Often we need to prioritize which solutions are to be implemented according to their relative costs and benefits. A Pareto analysis helps determine which improvements will give the best results.

The Pareto analysis tool is based on the Pareto principle, which states that “80% of the problems you experience are usually the result of a small number (20%) of causes” (also known as the law of the vital few).

The results from a Pareto analysis are normally displayed as a bar chart where it is possible to compare different causes, or problems. This makes it easy to see which of them contribute the most to improving security or safety levels or have the largest economic impact.

Remember to use dimensions that are comparable rather than different from each other.

**CORRECTIVE ACTIONS AND IMPROVEMENTS**

Process improvements that are identified through the systematic analysis of deviations, or that are suggested by operators, should be implemented by updating standards and standard practices.

Typical arenas to discuss and follow up deviations, corrective actions and improvement initiatives include:

- Morning meetings/shift team meetings in the plant
- Regular meetings with process experts
- TPM teams
- Specific project teams

Once again, efficient teamwork is the key to success in developing standardized HSE and operational practices.

*Example of Pareto diagram. The tallest bars (the vital few) show the main causes of/contributions to a result.*
The following sections look at each HSE element in turn:

Basic issues
Health and work environment
Safety
Security
Environment

Each section covers specific hazards, risk assessment and risk management tools.
Basic HSE issues are the issues facing all Hydro employees, with leaders having a special responsibility. Good implementation of the basics will make HSE targets easier to achieve and are a good starting point for any HSE campaign. These issues must be dealt with independently from site-specific hazards and risks.

**Hydro policy:**
We will remain a valued partner through our strong performance on health, safety, security and environment.

Conditions like these are dangerous and are not acceptable.
HOUSEKEEPING

Excellent housekeeping is a foundation for all HSE work and an important condition for achieving a high HSE standard.

Good housekeeping prevents errors/incidents because tools and instruments are in their assigned places, and ready for use. A systematic approach also helps establish a culture of cleanliness.

In Hydro, the 5S concept is used as a systematic method for establishing and maintaining efficient housekeeping. It simplifies the work environment, and reduces waste and non-value activities while improving quality efficiency and safety.

A tidy and clean workplace gives you a better overview, and makes it easier to avoid accidents.

5S - Housekeeping Campaign

SORT
Sort all components. Keep what is useful; get rid of what is not.

SET IN PLACE
Give all components their specific place where they are readily available for use.

SHINE
Clean the area. Find out how mess and disorder are generated

STANDARDIZE
Make sure that the standard established by the first three steps is maintained. "Nominate the person(s) responsible and accountable for maintaining the standard.

SUSTAIN
Nominate the person(s) responsible and accountable for keeping the standard. Audit on regular basis.

Easy to find = easy to use.
5S applied to a workplace in a Hydro plant. Each tool has its own labeled storage place.
Unexpected major incidents may occur at any time and can pose a great challenge to the affected location, the personnel involved and Hydro as a company. Each facility must have emergency preparedness plans (EPPs) that cover all incidents. EPPs must aim to protect personnel, the environment, assets and our reputation. Emergency Preparedness Training must be carried out annually at least.

Measures to reduce risks should be identified regularly and emergency planning should also cover residual risks (those risks remaining even after a number of measures have been put in place).

It is important to remember that emergencies will normally include aspects of each of the different HSE elements (health, safety, security and environment). This means your emergency planning must be comprehensive.

If you are the first person to discover an accident or incident, you must act according to the local Emergency Preparedness Plan.

The general course of action is:
1. Save personnel
2. Notify authorities and appropriate Hydro hierarchy
3. Help minimize the consequences (environment, property/assets, reputation)
4. Follow the emergency plans

Emergency evacuation plans must be posted in the immediate vicinity of every workplace. These must contain information about alarm signals and how to act in case of emergency.

Remember that for all HSE incidents, the order of priority for action is first to save personnel, then protect the environment, then assets and then reputation.

A manager may be assigned special responsibilities and authority regarding Emergency Preparedness. Managers should check their job descriptions or clarify this point with their own line managers.

Hydro requires the existence of emergency plans at all its facilities.

Plans shall be prepared and maintained for dealing with the full range of emergency conditions which can be envisaged.
Creating Emergency Preparedness Plans

Emergency Preparedness Plans cover both immediate and imminent threats to personnel, property, production and reputation. Managers will need to be open-minded when assessing the hazards facing the organization.

For example, emergencies damaging Hydro’s reputation, or those arising from “new” threats such as terrorism, are often overlooked but these must also be considered by managers and included when planning.

Considering the worst series of events possible is a good place to start.

Once the full range of hazards has been thoroughly assessed, a risk analysis must be used to create the EPPs (see Risk Analysis section 4.2).

The following questions should be asked:

- What can go wrong?
- The potential for physical damage and injuries to people must be included.
- What can be done to prevent it?
- Even if it goes wrong, are we prepared?

Next, identify relevant remedial actions if a risk is obvious. Think about what has to be done in the case of an emergency, and be mentally prepared.

HSE specialists can help you identify the full range of hazards and emergency scenarios, and provide advice for dealing with any subsequent media attention.

Take care:
Don’t try to be a hero in emergency situations; do not place your own life or health or that of others in danger

Be prepared for the unexpected!

Emergency preparedness plans should include what is to be done in case of illness, fire, explosion, transport or travel accidents and security threats. Your facility plans must be consistent with those above and below you in the organizational hierarchy.

The figure below shows topics and issues to consider:

**Example related NHC -CD04-01-HSE-05**
Emergency preparedness Plan - in order to mitigate consequences of an incident

Threat to:
- Life or health
- Environment
- Company assets
- Public property
- Commercial business
- Credibility and image

Incident

- Who calls?
- What has happened?
- Where and when?
- Number of names of persons involved?
- Need of assistance?
- What has been done?
- Others notified?

Depending on the situation, it is decided where to notify

Manager on call

Sector Emergency Preparedness Organization

HR
Communication
Authorities

Sector HSE Manager
Sector Manager

B A Manager
Corporate HSE Manager

Norsk Hydro President
Corporate Emergency Team

An example of the emergency reaction-chain for an incident.

Reference
NHC-CD04-01-HSE-05 - Emergency preparedness planning
**Emergency Preparedness Teams**

Many countries have regulations on how to organize local industrial defense teams. In this case, these teams must be a part of your local Emergency Preparedness team.

Members of the team must undertake frequent training to identify and cope with the specific hazards that may result in an emergency situation.

Hydro requires every organization to test their EPPs in the form of drills, to evaluate the exercise and to improve systematically. As a manager, you must ensure that adequate time is set aside to allow for training and evacuation drills to take place.

**Emergency response in the Hydro hierarchy**

Hydro managers are never “alone” when facing an emergency situation. Knowing how the rest of the organization will help you respond to an emergency is crucial. Managers must ensure they are prepared to cooperate with colleagues at other hierarchical levels within Hydro.

Your Sector or Business Area Emergency Preparedness Plans should give details of the kinds of incidents that will trigger Emergency Preparedness responses higher up the organizational chain.

Our Corporate HSE Emergency Preparedness Plan (NHC-CD04-2) focuses on when, how and who to contact within the Corporate Emergency Team (CET) and when and how to do this. The CET assigns responsibilities, reports regularly to the Board, the media and other interested parties and focuses on normalizing the situation.

**CET responsibilities:**
- Establishing an accurate picture of the situation
- Ensuring Hydro’s personnel are cared for
- Establishing crisis communications strategy
- Establishing image and reputation protection strategy
- Ensuring affected sector has relevant resources
- Planning for worst case scenario
- Establishing Hydro’s formal and legal responsibilities
- Ensuring analysis of the economic consequences
- Ensuring Sector emergency team is responding correctly
- Interfacing with authorities and interested parties

**Sector responsibilities:**
- Caring for affected personnel
- Bringing together necessary people and resources
- Decision making and inspecting critical choices
- Briefing and receiving feedback from CET
- Implementing crisis communications strategy
- Implementing image and reputation strategy
- Acting in accordance with Hydro’s formal and legal responsibilities
- Analyzing economic consequences
- Interfacing with authorities and interested parties as necessary

**Operational level responsibilities:**
- Immediate care of affected personnel
- Securing assets, environment and reputation
- Cooperation and communication with local authorities
- Implementing Hydro’s Emergency Crisis Management Plan

Reference

NHC.CD04-02 - Emergency preparedness plan for Norsk Hydro ASA - Corporate management
If you or your colleagues are traveling to Hydro facilities in your risk areas, information should be gathered on the following points before departure:

- Culture
- Religion
- Political situation
- Common crimes
- Corruption levels
- How to contact police/fire service and request medical assistance
- Embassy location and contact details
- Location and contact details of Hydro offices and facilities
- Arrangements for driving/local travel
- Good hygiene practices
- Vaccination certificates
- Communication channels
- Emergency procedures

From a manager’s point of view, the most important ways of minimizing travel-related risk are to ensure that employees who travel are trained for assessing risks, and to carry out pre-trip planning. This includes, risk assessment, tracking information, emergency preparedness and making sure they have the correct travel documents. Those going to medium and high risk areas should have an extensive training course in risk management.

Line managers have a duty to carry out Threat and Vulnerability Assessments (Ref. CD04-1-HSE17-Travel App. 1) in order to risk assess travel destinations and the activities undertaken there by their personnel.

Employees themselves will need to follow NHC-CD04-HSE-17.

Tools relating to travel security are available on the Corporate HSE Intranet.
CHEMICALS

The correct management of dangerous chemicals is crucial for Hydro.

Our employees may be exposed to chemicals by inhaling gas, vapor, aerosols or dust, or through liquids, oils or dirty surfaces contacting the skin.

Risk management and chemicals
Assessing and controlling the risks related to storing and handling chemicals is a complex task that usually requires specialist help.

This complexity also means that managers of facilities where chemicals are used should ensure that they and key employees are fully trained in chemical risk assessment and emergency procedures.

Hydro has an electronic system for organizing and handling Material Safety Data Sheets (MSDS): ECO Online.

Regulations and chemical use
Most countries have extensive legislation relating to hazardous chemicals, which must be complied with.

Common elements in chemicals legislation are:

- Lists of Occupational Exposure Limit values (OELs)
- MSDS: these provide detailed information on each chemical substance incl. first aid measures, fire fighting, Personal Protective Equipment (PPE).
- Classification and Labeling rules dictate how chemicals must be labeled.

New rules in European countries (REACH) mean that the use of chemicals that are carcinogenic (causing cancer) or mutagenic (capable of causing mutation in the body) must be approved by the European authorities on a per company basis and strictly monitored. These stringent new rules are likely to be adopted by other governments around the world over time. Contact central HSE staffs for the latest information.

Managing Chemicals – 10 Golden Rules:

1. Keep inventories up-to-date
2. Purchase less hazardous substances whenever possible
3. Storage facilities must be as a minimum in accordance with Hydro standards
4. Have clear procedures in place for labeling, including the removal of labels
5. Have clear procedures for handling chemicals, including rules for dealing with spills, and correct use of Personal Protective Equipment
6. Have clear procedures in place for the disposal of chemicals
7. Make sure emergency response plans cover protection of employees, neighbors and the environment
8. Make information regarding chemicals available (SDS, workplace safety card)
9. Give clear instruction for work processes involving chemicals
10. Ensure adequate training of personnel handling chemicals

REACH - Overview
One single & coherent system for new and existing chemicals Core elements:

- Registration of chemicals > 1 ton/year
- Evaluation of some chemicals
- Authorization for chemicals of very high concern
- Information on substance hazards along the supply chain
- Intended use covered in the risk assessment of substances
- EU agency to manage the system

Focus on priorities

- Direct obligations as manufacturer/importer/downstream user (DU)
- Indirect risks: continuity of supply / substances withdrawn from the market due to non-proportional registration costs for the substance provider

Shift of responsibilities from authorities to industry

Business implications
REACH is a business issue not just a HSE issue
REACH is a major supply chain issues with a regulatory driver
Hydro requirements regarding chemical use
When implementing measures to reduce chemical risks, as a manager you must ensure that:

Hydro requirements for design of plants/processes involving chemicals are met

Our Hydro standard “Storage of hazardous materials” is met. This focuses on how such materials can be retained, and disposed of safely in our facilities

Engineering and administrative measures are in place from the beginning

Substitution with less hazardous substances occurs whenever possible

Use of Personal Protective Equipment (PPE) is a measure that is only adopted for a limited period or when other measures are inadequate

Storage tanks have remote-controlled, fail-safe systems for safe and rapid isolation in the event of accidental release or leak

All automated safety functions are fail-safe, i.e. go to a safe position in the case of problems with power or air supply or signal malfunction

“Controlling chemical risks related to personnel” requires that multiple safety barriers are in place for events with potentially severe consequences (fatality, hospitalization) of hazardous or long-term exposure. If one barrier fails, there will be another safety measure that prevents a major accident.

Personal Protective equipment - PPE
(including personal protective clothing)

Hydro has implemented a standard for PPEs. Specifications as well as request forms are available on the Hydro intranet.

REPORTING
Reporting HSE incidents and sick leave data

Hydro has drawn up indicators of HSE performance that must be reported to Corporate level. This is done in order to:

Measure, communicate and benchmark performance

Promote improvement of HSE issues

Improve preventive efforts through the sharing of experiences across the business

For each business site this includes a set of defined data related to:

- Accidents
- Lost time injuries
- Restricted work cases
- Near misses
- Security breaches
- Security breach attempts
- Sick leave
- Employees and hours worked
- Permit breaches
- Work Related Illness - WRI
- WERA results (WERA-KPI)

Sick leave includes:

- All absence due to work and non-work-related illness and injuries

Sick leave does not include:

- Maternity leave
- Child carer’s leave
- Personal days off
- Leave of absence

References:
CD04-1-HSE-06: Storage of hazardous materials
NHC-CD04-01-HSE-04: Controlling chemical risks related to personnel
NHC-CD04-01-HSE-14: Control room integrity and operability
CD04-1-HSE-11: Plant design, construction, modification, and decommissioning
As a manager, you are responsible for collecting the required data, and reporting this monthly, by using of Hydro’s Synergi reporting system.

Hydro policy:
Publicize our goals, promote transparency in our HSE reporting and engage in cooperation with interested parties.

Hydro requires that all incidents are investigated and documented.

HSE incidents classified as having “actual or potential major consequence” must be notified immediately and without delay to line management and Sector HSE.

Based on these values, HSE-indicators are calculated based on the following:

**LTI – rate:** Lost Time Injuries. Number of injuries resulting in absence, per million work hours

**TRI- rate:** Total Recordable Injuries, including LTI, cases of restricted work and medical treatment. Number of cases per million work hours

**% Sick leave:** Lost work hours as a percentage of possible hours worked

**T: rate:** A value for the technical safety level

All Business Areas/Sectors must have written requirements for how sites will manage cases of work-related illness. An overview of such cases must be maintained. Records must be made available on request.

**ANALYSIS, INVESTIGATION AND FOLLOW UP OF ACCIDENTS AND INCIDENTS**

The timely and accurate reporting of accidents and incidents through line management is crucial. Reporting allows Hydro to limit personnel injuries, assign the correct resources to an incident, ensure local managers are supported, limit damage to property and share best practice so that other managers can avoid similar incidents.

There are three levels of investigation within Hydro:

**Level 1** is used to denote initial reporting and investigation. Level 1 investigation is used for all incidents.

**Level 2** is used to denote a systematic investigation performed by an internal group. Level 2 investigation is used for accidents and repeated near misses classified in the yellow area of the Synergy Risk Matrix, and is also the minimum requirement for near misses classified in the red area, see CD04-1-HSE-02, appendix D, figure D-1.

**Level 3** is used to denote a systematic and in-depth investigation performed by an independent commission. Level 3 investigations are used for accidents classified in the red area of the Synergy Risk Matrix, or for near misses with catastrophic loss potential.

References:
NHC-CD-HSE-02 HSE incidents and sick leave data
CD04-1-HSE-03 -Analysis, investigation and follow-up of accidents and incidents
The purpose of our incident reporting system is to:
- Understand the causes of the incident
- Identify appropriate improvements
- Share lessons learned
- Provide input for emergency scenarios

Managing an investigation
The purpose of investigations following incidents is not to appoint blame. It is to avoid making the same mistakes in the future and to protect our employees. In carrying out investigations, always make this clear to everyone involved immediately.

The investigation should be carried out as soon as possible after the event, even for incidents that seem trivial.

Ask open questions that allow employees to answer in detail and in their own way, not just yes or no ("what happened?" rather than "did x and y happen?"). Be particularly sensitive toward those who have been directly involved and may be shocked, angry or feel guilty.

When a group is appointed to investigate the event, the following steps should be included before the investigation is completed:
- Review the group's mandate, tasks and guidelines
- Plan and delegate tasks and responsibilities
- Collect data and information
- Sort and analyze data and information
- Identify direct and underlying causes, safety barriers in place and barriers broken
- Identify deviations from requirements or expectations, lack of procedures, specifications, training, follow-up, etc.
- Review the actual circumstances and consider what is the worst that could have happened
- Propose actions to be taken – and ensure that they address the root causes
- Prepare the report and present it to the owner of the investigation
Healthy work environment
An unhealthy work environment may be a serious threat to our employees and to productivity. We have an obligation to focus on health as part of HSE management for the following reasons:

Moral: Work at Hydro should not induce illness, nor harm the health of employees, in the short or long term.

Legal: Global and national requirements must be complied with, such compliance forms the basis for our continued “license to operate”.

Financial: Illness and damage to health are expensive for the business (absence, relocation, temporary staff, training, overtime, productivity loss etc.)

Corporate policy and Hydro expectations
Hydro is determined to work ambitiously, through continuous improvement, for a healthy work environment to avoid new work-related illness.

A manager’s main responsibilities governing health and work environment cover the following areas:

- Identification of risk and introduction of risk-reducing measures
- Management of health and work environment in general
- Intoxicants and alcohol
- Reporting of sick-leave and work-related illness
- Travel (see section Basic HSE Issues above)
- Chemicals (see section Basic HSE Issues above)

Hazards in the work environment:
Normally occurring strains and exposures in daily work are risk factors in the work environment.

Long-term and high-level exposure without any acute health effects may, over time, lead to ill health, work-related illness and absence.

Hydro policy:
- “We will work towards employees being healthy, motivated and productive”
- We will prevent work-related illness and absence

In many countries, it is compulsory to have an Occupational Health Service (OHS) within Hydro’s type of business, either as an in-house service or contracted service. When contracting an OHS, you, the manager, must have detailed knowledge of national regulations in order to ensure that all necessary details are included in the contract.

References:
NHC-CD04 Health, Security, Safety and Environment (HSE)
NHC-CD04-01-HSE-08 Management of health and work environment – Minimum requirements
NHC-CD04-01-HSE-06 Storage of hazardous materials
NHC-CD04-01-HSE04-Controlling chemical risks related to personnel.
### Hazard (Sources) Possible health effects

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Possible health effects</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Noise</strong></td>
<td>Permanently impaired hearing, tinnitus (continuous sound in the ear)</td>
</tr>
<tr>
<td>(Machinery, tools, vehicles etc.)</td>
<td></td>
</tr>
<tr>
<td><strong>Vibrations</strong></td>
<td>White fingers: damage to blood vessels and nerves in fingers</td>
</tr>
<tr>
<td>(Vehicles, hand-held tools, floor/base)</td>
<td>Whole body: Back pain, lumbago, balance problems, headache</td>
</tr>
<tr>
<td><strong>Chemicals</strong></td>
<td>Lung disease, cancer, allergies, eczema, skin diseases, damage to nerve system and inner organs etc.</td>
</tr>
<tr>
<td>(Dust, gas, vapor etc. from raw materials, auxiliary chemicals etc.)</td>
<td></td>
</tr>
<tr>
<td><strong>Heat stress</strong></td>
<td>Skin effects, loss of body fluid, faintness, temporary unconsciousness, heat stroke</td>
</tr>
<tr>
<td>(Molten metal, hot surfaces, foundry equipment etc.)</td>
<td></td>
</tr>
<tr>
<td><strong>Cold Stress</strong></td>
<td>Hypothermia, frostbite, loss of dexterity in fingers/hands</td>
</tr>
<tr>
<td>(contact with cold surfaces, tools or fluids, work at quayside areas, contact with aluminium and steel at temperatures below 0°C)</td>
<td></td>
</tr>
<tr>
<td><strong>Ergonomic strains</strong></td>
<td>Muscle/skeletal problems (neck, back, arm, shoulder, elbow, knee, etc. often in connection with psychosocial stress)</td>
</tr>
<tr>
<td>(Heavy lifting, awkward work positions, monotonous work etc.)</td>
<td></td>
</tr>
<tr>
<td><strong>Psychosocial and mental strains</strong></td>
<td>Mental illness, reduced motivation and work performance, burn out etc.</td>
</tr>
<tr>
<td>(work load, work organization, leadership, travel load)</td>
<td></td>
</tr>
</tbody>
</table>

Examples of hazards, their sources and related health effects.

Due to the time lag between exposure and the development of a health effect/damage, normally occurring exposures may be neglected compared to acute hazards.

In Hydro, we assume that 20-50% of all absence due to illness is the result of exposure and strains at work. It is the responsibility of managers to assess these risk factors and carry out the necessary control measures.

Chemicals, noise and heat stress are major hazards within Hydro.
### Work-related illness vs. injury

Many work-related illnesses are long-term or chronic and must be prevented rather than cured. The table above pinpoints some differences between work-related illness and injuries:

<table>
<thead>
<tr>
<th>Work-related illness (long-term health effect)</th>
<th>Work-related injury (acute health effect)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The result of prolonged exposure through daily work (physical, chemical or psychosocial and mental factors)</td>
<td>The direct result of an accident or single exposure at work</td>
</tr>
<tr>
<td>Often difficult to describe:</td>
<td>Easy to describe:</td>
</tr>
<tr>
<td>• Many years pass from the time of exposure to illness symptoms (for cancer up to 50-60 years)</td>
<td>• Time and place of event</td>
</tr>
<tr>
<td>• Caused by a combination of exposure at present and former work, private activities and genetic heritage</td>
<td>• Primary causes</td>
</tr>
<tr>
<td>• Damage to health may worsen over time if exposure continues</td>
<td>• Health damage</td>
</tr>
</tbody>
</table>

Managing the risks associated with work-related illness is a serious challenge. It involves becoming very familiar with the risks and working consistently to change employee perceptions and behavior. The personal involvement of shift leaders, particularly in enforcing use of Personal Protective Equipment, is very important.
Risk assessment and management for a healthy work environment

In addition to assessing the running operation and to avoid future problems, risk assessments must always be performed in advance of planned modifications and both physical and organizational changes, as part of the planning process.

The risk assessment must be updated regularly (every 3-5 years) to allow for any changes in hazards or medical knowledge, and as part of the continuous improvement process.

Risk assessment of psychosocial and organizational factors
Hydro has no centralized method for assessing psychosocial and organizational risk factors at local level.

Hydro Monitor (Hydro’s employee satisfaction survey) will give you an overview of areas that you need to address further.

As a leader, it is appropriate to raise such issues (e.g. stress, long hours) during appraisal interviews such as those used for the Hydro Leadership Development Process (HLDP).

Risk assessment of physical and chemical factors
Hydro’s standard method for assessing the physical and chemical parts of the work environment is the Work Environment Risk Assessment (WERA) described in appendix B to this handbook.

WERA provides a detailed description of how to assess risk.

It provides leaders with a simple assessment table, displaying risk factors in green, yellow and red in a matrix. The method ensures a systematic review of the workplace and identifies both the operations and employees at risk and it provides a decision base for implementing risk-reducing measures.

It covers chemicals, noise, vibrations, ergonomic factors and temperature stress in industrial work places as well as office facilities.

Noise
Noise at the workplace is the cause of our most common WRI: hearing impairment. Hearing impairment can’t be cured, only prevented!

Temperature stress
Efficient bodily functions are dependent on a stable body temperature of 37 °C (99 °Fahrenheit). Work in hot areas or at Hydro facilities located in tropical, desert or cold climates has a significant impact on the body.

Temperature stress means the natural mechanisms regulating heat in the body are overloaded. Heat or cold stress may be of particular concern among expatriate workers operating in a climate they are not used to.

Heat or cold stress can result in reduced alertness, loss of manual dexterity, dizziness, heat stroke, hypothermia and even death. In other words, there are serious potential consequences for employee health and operations.

Understanding the early warning signs of heat and cold stress is the most important aspect of managing these hazards. Leaders must also ensure that routines and measures are put in place to allow employees sufficient breaks and liquids during the working period.

A good tool to help understand the impact of temperature on employees in your area of responsibility is to carry out operative work for a day in full Personal Protective Equipment.

Managing heat
Heat stress is a serious issue within Hydro. Initial symptoms include skin irritation, red rosette markings on the skin and small blisters. Dizziness, fainting, reduced blood pressure and periods of unconsciousness may follow. If body temperatures continue to rise, heat stroke, coma and death can occur.

Heat stress can be managed:
• Risk assessment: WERA (see page xx), measurement of the WBGT-Index (see box) for typical plant tasks.
• Engineering controls: ventilation, spot cooling, shielding from radiant heat sources, cool rest areas as close to working areas as possible, enclosed and air-conditioned mobile equipment and crane cabins.
• Work practices: replenishing fluids, regular breaks in cool areas (short, frequent work-rest cycles), job rotation between areas with different heat exposure, reduced manual labor, sufficient time for acclimatization, protective equipment and clothing, evaluation of need for reduced-hour schedules or extra manning, scheduling of labor-intensive tasks in cooler periods (night, early morning).
• Education and training: heat stress awareness, focus on early signs and symptoms, and the importance of regular fluid intake. First aid training should be regularly updated.

Hydro requires that all organizations assess risks related to chemical, physical, social, human and organizational factors, which may represent a hazard to human health and the environment, both in the short and long term.

Hydro Monitor is the corporate HR tool for assessing organizational development and employee satisfaction.

WERA
Work Environment Risk Assessment
Corporate standard method for risk assessment, and improvement of the working environment

Example of noise map for a working area.

References:
HSE handbook Appendix B - Work Environment Risk Assessment
Managing Cold
Cold stress normally occurs during work below 0 °C (32° Fahrenheit) in combination with wind, or for work where hands and fingers are in contact with cold surfaces, tools or fluids.

Cold stress can be managed by:
• Clothing: A combination of adequate clothing and physical activity is decisive for avoiding cooling of the body and the risk of frostbite. For long-term exposure to the cold, triple-layer clothing is recommended. Underwear should be made of artificial fibers or wool, not cotton, to keep the skin dry. Middle layers must insulate, for instance wool or fleece. Outer layers must be wind and waterproof. Insulated footwear, headwear and gloves should always be provided.
• Avoiding contact cooling: This occurs when the skin comes into contact with aluminium or steel without gloves at temperatures below 0 °C (32° Fahrenheit). Such contact will cause pain, numbness and frostbite within seconds. Leaders must ensure the correct and consistent use of Personal Protective Equipment.
• Work practices: Outside work in exposed areas must be limited according to the temperature and the intensity of the work. Please see the Appendices for further details.

Records
Measurements from monitoring and exposure data must be documented.

Pro-active performance indicator (WERA-KPI)
Based on the results from a plant or area assessment, a pro-active performance indicator can be calculated. The performance indicator is a management tool used to set focus, provide an overview and encourage and monitor improvements.

The WERA-KPI provides a figure between 0 and 300, where zero reflects the target (all green risk) and 300 represents the opposite end of the spectrum (only red risk/high risk).

See the WERA pages on our Intranet for more details.

Health surveillance, medical records and rehabilitation
Sector and Unit line leaders must assess the need for local health personnel and are responsible for establishing an Occupational Health Service according to national legislation and Hydro’s requirements.

Intoxicants and alcohol
The use of intoxicants (which means “all substances regulated by national drug legislation”) and alcohol may severely affect job safety, and result in reduced alertness, undesirable behavior and worsened job performance.

For this reason, Hydro promotes a work environment free from intoxicants. All employees must be sober, substance-free and fit for work during all activities on behalf of Hydro. Exceptions are made for the serving of limited amounts of alcohol in work-related social contexts.
There is growing acceptance of narcotic substances in society, with an increased abuse of pills and medicines. This means abuse issues are relevant for all types of employees and must be explored when appointing new personnel.

Hydro promotes a work environment free from intoxicants in all its businesses.
“In general, all employees are to be sober, substance-free and fit for work in all their activities on behalf of Hydro.”
“It is prohibited to consume, offer or be under the influence of alcohol in the workplace.”

<table>
<thead>
<tr>
<th>Blood alcohol level</th>
<th>Acute effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2</td>
<td>Reduced ability to focus rapidly and adjust to light and dark.</td>
</tr>
<tr>
<td>0.5</td>
<td>Reduced ability to perceive the situation and react precisely.</td>
</tr>
<tr>
<td>0.8</td>
<td>Impaired coordination, along with increased reaction time.</td>
</tr>
<tr>
<td>1.0</td>
<td>Impaired attention and power of concentration, onset of tiredness, reduced sense of balance and reduced ability to move.</td>
</tr>
<tr>
<td>1.5</td>
<td>Impaired ability to move.</td>
</tr>
<tr>
<td>2.0</td>
<td>Symptoms of intoxication.</td>
</tr>
<tr>
<td>3.0</td>
<td>Risk of unconsciousness. Loss of control of bladder control.</td>
</tr>
</tbody>
</table>

Hydro policy and requirements on intoxicants and alcohol

Hydro accepts addiction as an illness, promotes openness on the issue and offers help to those involved. All units should be able to refer employees with alcohol or substance abuse problems to treatment programs and after-care when they voluntarily seek help.

Hydro policy and requirements on intoxicants and alcohol

All units must have routines in place for testing, where this is allowed under national law. Random and periodic testing must be performed in accordance with national legislation.

Under “Management Responsibility”, the web site provides:

- Tests on alcohol consumption
- Examples of Best Practice within Hydro
- Access to Corporate Steering Documents
- Links to relevant external websites in many countries

Hydro requires all leaders to implement the requirements and communicating Corporate policy to all employees.

A website has been established on the HSE Portal to assist leaders and employees in implementing Hydro’s policy and requirements.

The website provides the following help:
- General facts about alcohol and drugs
- Questionnaires on attitudes to alcohol
- Tests on alcohol consumption
- Examples of Best Practice within Hydro
- Access to Corporate Steering Documents
- Links to relevant external websites in many countries

Under “Management Responsibility”, the web site provides:
- Presentation material as a basis for communicating with employees
- “The inevitable conversation” - assistance for leaders in the event of early signs of substance abuse in employees

If you feel you would like specialized training in this area, please contact Corporate HSE.

The Occupational Health Service will perform health surveillances on an individual basis to:
- Document work-related health
- Identify any kind of work-related illness
- Evaluate working capacity
- Give advice on individual adjustment of working conditions
- Evaluate health status with respect to new positions and expatriation
- Recommend preventive measures and health promotion
- Document health status in the event of future lawsuits or epidemiological studies

Medical records

The Occupational Health Service must establish medical records (health journals) for all employees containing relevant work-related information.

The records are the property and responsibility of Hydro, and must be stored in accordance with national legislation.

In the event of site closure or divestment, the records must be kept by Hydro or transferred to the competent national authority.
Safety has received great attention in Hydro. This has resulted in improved safety performance, as well as an organization that is conscious of HSE matters.

Occupational safety and process safety are the two areas of safety work in Hydro.

The fact that reporting of small incidents and near misses are quite frequent in daily work means there is a relatively high focus on occupational safety in Hydro.

Major process-related accidents, on the other hand, do not occur frequently in a plant. The associated risks may still be high since the potential consequences can be severe. The consequences may sometimes be third party fatalities or complete destruction of a plant. The safety measures mentioned above are normally not sufficient to prevent such accidents.

As a leader, you must focus both attention and awareness on:
- The risks posed by events that occur relatively frequently but have relatively minor consequences
- The risks posed by events with very low probability but with potentially fatal consequences

Safety risk assessment
Managers need to use different types of assessments in order to understand risks and prevent accidents or incidents. Risk assessment is discussed in general in Section 4.2

HAZOP (Hazard and Operability analysis) is a tool for analyzing the production process by studying its Piping and Instrument Diagrams (P&IDs) to identify possible weaknesses and risks (deviation from a safe condition).

It provides a detailed overview of possible causes of critical accidents.

HAZOP requires the participation of both from local personnel who know the plant and professionals.

There are several other methods of safety risk assessment. A selection of the most relevant methods is described in more detail in Appendix A, including further guidance concerning which method is suitable for what, and Hydro’s recommended practices.

Two other important safety risk assessment tools are outlined below: SIL (Safety Integrity Level) analysis and QRA (Quantitative Risk Analysis).

**Safety Integrity Level (SIL)**
This is a semi-quantitative method for deciding whether safety functions are needed, and if so, what their reliability level should be.


A Safety Integrity Level assessment should be performed for all process steps which represent major or moderate process hazards and where safety instrumented systems are implemented.

A Safety Integrity Level assessment addresses safety instrumented systems based on the use of electrical/electronic programmable technology. However, IEC 61511 also recognizes that safety systems can rely on other technologies.

A LOPA (Layer of Protection Analysis) does the same as SIL assessment, but includes safety barriers based on other technology (e.g. mechanical) as well. For most practical purposes SIL and LOPA are the same.

**Hydro policy:**
Demonstrate determination in protecting personnel, premises and activities against conscious and negligent and unauthorized actions, balancing the company’s need for protection with the integrity of employees and third parties.

**Examples of measures to reduce the risks of minor accidents:**
- Operational procedures
- Behavioral training
- Personal Protective Equipment
- Guardrails

To prevent fatalities and disabilities: Enforce good practices to reduce risks in the work place to an acceptable level. This requires competent and trained leaders and work force, with the right attitude and behavior.
Quantitative Risk Analysis (QRA)

The objective here is normally to assess the acceptability of the plant, for instance by evaluating the need for improvements.

A Quantitative Risk Analysis is normally used to gain a picture of the plant’s total risk contribution of the plant to its surroundings or to specific vulnerable areas internally (e.g. control rooms, office buildings).

A total Quantitative Risk Analysis reflects the complete risk which a Hydro unit represents. This differs from qualitative techniques that show the risk of individual hazards or events.

A QRA should be performed for plants which represent a hazard of multiple fatalities for their surroundings or within specific internal vulnerable areas. QRAs are useful when the hazard picture is complex, for instance when several risk elements are present.

Risk reduction

“Zero accidents” is the ultimate goal of risk management. When working towards this goal, focus must be placed on risk reduction.

This can be done either through making major changes to plant design, plant operation or maintenance, or as part of a continuous improvement program. These elements are outlined below.

1. Introduce safety measures that reduce the inherent hazard of the operation.
2. Creation and categorization of risk-reducing measures should be prioritized in the following order of preference:
   - maintain barriers to prevent the development of incidents/accidents, or limit the consequences
3. Preventive maintenance
4. Operational instructions

More detailed description of risk management tools and techniques can be found in Appendix A - Safety Risk assessment.

We are determined to have no injuries on our premises, and work continuously to avoid … property damage and production loss.”

If accidents occur, we shall be prepared to do the utmost to prevent and mitigate injury, damage to the environment, property and Hydro’s reputation. Saving life has the highest priority.”

Use HAZOP Analysis to:

Identify design weaknesses which might cause serious accidents or operational problems in complex installations with high risk factors.

HAZOP shall be performed in all plants, technical installations or processes, that handle hazardous materials, reactions, temperatures, pressures, etc.
Risk assessment in the design of plants and processes

Risk assessment is a basic element in the process of designing a new plant. The table below shows the risk handling in a typical project process for preparing a plant.

Risk assessment methods during project phases as defined in Hydro’s CVP process

<table>
<thead>
<tr>
<th>Project phase</th>
<th>Recommended actions</th>
</tr>
</thead>
</table>
| Business idea development     | • Identify inherent safety options  
• Checklist/Hazard identification |
| DG (Decision Gate) 1          |                                                                                     |
| Feasibility study             | • Identify inherent safety options  
• Checklist/Hazard identification  
• Preliminary Rapid Risk Ranking, or What-if analysis |
| DG2                           |                                                                                     |
| Concept selection phase       | • Re-assess inherent safety options  
• Full Rapid Risk Ranking  
• If Piping and Instrument Diagrams (P&ID) are required: Preliminary HAZOP  
• If relevant*: Preliminary Quantitative Risk Analysis (QRA) |
| DG3                           |                                                                                     |
| Preparation for execution     | • Rapid Risk Ranking update  
• Safe Job Analysis of critical tasks  
• If P&IDs are required: Full HAZOP  
• If relevant*: Safety Integrity Level (SIL) analysis and/or Quantitative Risk Analysis (QRA) |
| DG4                           |                                                                                     |
| Execution                     | • To prepare for operation:  
• Update all previous studies to as-built  
• With respect to commissioning:  
• Rapid Risk Ranking (RRR)  
• Safe Job Analysis (SJA) |

*Relevant e.g. for complex plants with a potential for major accidents
Hydro design requirements for plants, processes and buildings

Hydro’s HSE design standards are based on international standards.

Risk reduction through design requirements must be applied in the following order:

- Inherent safety
- Barriers preventing the development of / limiting the consequences of incidents/accidents
- Operational instructions

Inherent safety

Inherent safety is the integration of safety functions into the process, machine or device in order to prevent accidents or incidents. An inherently safer design is one that avoids hazards instead of controlling them. The concept can be described using four keywords:

Minimize (or intensify): use only small quantities of hazardous materials; reduce the size of equipment operating under hazardous conditions (e.g. high temperature or pressure)

Substitute: use fewer hazardous materials, processes, or conditions

Moderate: (or attenuate): reduce hazards by dilution, refrigeration, or process alternatives to use lower temperatures and pressures

Simplify: eliminate unnecessary complexity, have “user-friendly” plants

Inherent safety, an everyday example:

A one-storey house is inherently safer than a house with several floors, since stairs frequently cause injuries.

In multi-storey houses, handrails and child-gates reduce the probability of injury, but a one-storied house remains safer.

Override control

Normally, automated safety functions must not be overridden. If it is necessary to override safety functions, then compensating measures must be implemented.

Routines for approval, effectuation and documentation must be put in place, clearly communicated and strictly enforced. As a manager, you must include measures to avoid unnecessary overrides and limit their duration. Such documentation must be filed.

Availability of technical safety barriers (T-rate)

The T-Rate is our KPI representing the availability of technical safety barriers.

The T-rate is Hydro’s mandatory system to evaluate the condition of critical equipment and technical barriers. It is based on tests and inspections of barriers and the monitoring of overrides to ensure that selected barriers are working correctly.

The T-rate must be monitored and reported every month. An e-learning course for Hydro personnel with T-rate responsibilities is available on the HSE Portal on the intranet.

The T-rate consists of three elements:

- The barrier test element
  Includes results from testing of safety-critical barriers e.g. emergency stop buttons, switches, temperature/pressure level switches, emergency shutdown valves, light curtains etc.

- The inspection element
  Includes e.g. results from inspection of critical safety equipment, like pipelines, tanks, vessels, lifting equipment etc.

- The override element
  Includes active overrides of safety critical systems and equipment.

The T-Rate is developed as a KPI for technical safety, based on monthly barrier tests and inspections.

References

- NHC-CD04-01-HSE-15 Operation
- NHC-CD04-01-HSE-19-Technical safety data reporting
Maintenance of assets

It is important to know what responsibility and authority you have with regard to maintenance of Hydro’s assets in your area. Managers must ensure correct procedures are followed and help improve the process.

Prioritization of maintenance work should be based on a judgment of risk in relation to:
• Violation of public laws and regulations
• Non-fulfillment of customer requirements
• Damage of material goods
• Production loss

Maintenance programs for facilities should be based on the criticality classification of the equipment. Proper preventive maintenance reduces the probability of functional failures.

Basic elements in the development of maintenance programs are:
• Criticality classification of equipment and systems
• Maintenance plans and routines
• Technical documentation
• Spare parts

Modifications

There are many examples of fatal accidents caused by a modification.

Modifying equipment creates risks because of changes in operations from a “safe state” to a potentially “unsafe state”. The challenge is to control the changes in order to maintain the safety level.

A modification is defined as:
• Any change in plant or equipment with regard to construction or materials
• Any change in process medium or conditions beyond design
• Any change to safety, security or control systems
• Any change in documented routines

When carrying out modifications, the following rules are absolute:
• All modifications must be registered, and approvals documented and filed
• Those involved in carrying out modifications must have training/proper competence to carry out the risk assessment
• The problem to be solved and/or what will be gained must be stated in writing
• All existing requirements apply, and required certificates, approvals, etc. must be obtained
• Specialists must be involved, to the extent necessary
• HSE risk assessment must be carried out
• Mandatory technical documentation must be updated
• Personnel impacted by the modifications must be informed and trained

Modification and decommissioning of plants must be controlled. Adequate local procedures must be established in order to achieve safe project execution and safe, functional and reliable production plants.

Remember:

Your organization must have a Modification procedure and a defined working process in place.

This must include defined responsibilities, authorities and approval milestones

In order to avoid hazardous situations, it is the manager’s responsibility to check results and approvals before commissioning starts following a technical modification.

Always make sure that competent personnel assess hazards and risks related to safety, security, environment, and healthy work environment.

Before any modification work is started, ensure that correct as-built documentation is available. All interfaces (organizational, geographical and professional) must be well defined and communicated.

In the event of major reorganizations, hazards and risk shall be assessed in a similar way as for technical modifications.

References:
NHC-CD10 Risk management
CD04-1-HSE-08 Management of Health and work environment - minimum requirement
CD04-1-HSE-11 Plant design, construction, modification and decommissioning
Other risk management elements of maintenance

There are several elements that may reduce the consequences of equipment or process failures. For example, modifications and a well planned stock of spare parts. If the consequence of a given failure is very high, a modification should be considered in order to obtain an acceptable risk level.

When the risks related to failure are very high, risk-based maintenance programs should be set up for equipment and systems.

Condition Monitoring is used to predict how the condition of machines and equipment will develop over time.

Note:
Condition-based maintenance shall be the general preference.

When you generate maintenance programs
RCM/FMECA may be used.

RCM: Reliability Centered Maintenance
FMECA: Failure Mode Effect and Criticality Analysis

Criticality classification

<table>
<thead>
<tr>
<th>Least critical equipment</th>
<th>Medium level critical</th>
<th>Highly critical equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrective maintenance will normally be the strategy (run-to-failure)</td>
<td>A combination of preventive and corrective maintenance depending on the situation</td>
<td>Comprehensive preventive maintenance and inspection programs will be necessary</td>
</tr>
</tbody>
</table>

Ensure that a qualified maintenance and inspection program is in place and that systematic maintenance is carried out.

Hydro’s maintenance standard CD04-HSE-12 must be implemented.

Production facilities shall be maintained systematically in order to ensure their technical state. For example, production facilities should be capable of operating safely, economically and with a high level of regularity throughout their lifetime. You are also required to maintain decommissioned plants. If not, they must be demolished.

Preventive maintenance also covers buildings.

References
NHC-CD10 Risk management
CD04-1-HSE-12 Systematic maintenance
Safe practices

“I was only going to…”

Failure to secure the workplace before work start-up has been a major cause of fatal accidents in Hydro. This is unacceptable. The most important tools for preventing such accidents are outlined below.

The work permit

The work permit defines mandatory precautions to prevent accidents and maintain production integrity when performing potentially hazardous work.

Work permits are required for all work carried out over a limited time period:

- For regular production/operation tasks, work permitting is covered by written procedures and routines
- Work Permits are not required for construction work defined as being outside production areas (“greenfield”). These areas require their own equally safe work routines.

The authorized person, e.g. the operating supervisor - called “the permit issuer” - defines the specific safety measures. The permit issuer (also known as the operating supervisor in charge) is responsible for the handover and the permit process. The permit issuer must ensure that a qualified person, who is chosen by the site, performs the necessary risk assessment - this includes specifying and carrying out safety measures that arise as a result of the work permit process.

The person(s) doing the specified work - the recipient – formally accepts the safety measures before doing the job. The recipient is required to check the necessary safety measures and follow them as defined by the issuer.

All permits must be prepared on printable forms, and be signed, registered and filed by the permit issuer.

Work permit systems require training of both permit issuers and recipient.

There are several tools to be used with work permits. Among these are Safe Job Analysis (SJA) (See Section 4.2), that help you identify risk potentials in the job and plan preventive measures to reduce risks when carrying it out. Another important tool is Energy Control – this helps control hazards caused by energy sources.

Work permits

The work permit system is Hydro’s mandatory, formal system for written proof of permission to carry out specified work in a specified area or on specified equipment for a limited time period. The system is based on risk assessment and prevention.

Note:
Work permits shall be used to ensure that specific work on potentially hazardous machines or equipment are carried out in a safe manner, that operation responsible is informed, and that adequate precautions are taken to prevent accidents and maintain production integrity.

The Issuer

The authorized person who is responsible for defining and implementing safety measures.

The Recipient

Responsible for evaluating and checking the safety measures before doing the work.

References:
NHC- CD04-1-HSE-13- Work permits
Energy Control

Machines and equipment in our facilities contain energy in different forms, such as electricity, heat, gas, pressure or movement.

Several accidents in Hydro - involving machines where energy potentials were released unexpectedly - have resulted in grave injuries and fatalities.

The main risks of handling such energies are:
- Unexpected energization, or start-up, of machines
- Release of stored energy
- Working within high-risk zones of live machinery

It is imperative to control energy and create barriers between machine-bound energy and those who are physically in touch with the machines.

The main principle should always be to shut off all energies before entering the hazardous area for inspection, service or maintenance.

Remember

Make sure machines are energy-free before you start the maintenance!
Lockout
Establishing Lockout means all machines/equipment are assessed for energy that poses a potential risk for personnel.

Lockout requires thorough planning on the part of managers. A systematic mapping of Lockout points is required and detailed routines for locking out energy need to be prepared. Correct training is essential. Lockout must be used together with Work Permits.

A Lockout system consists of three main elements:
- Establish lockout routines for shutting off energy
- Train employees to follow the system
- Audit the system – how well is it working?

When performing Lockout the following is needed as a minimum:
- A written policy on Energy Control which is available to and understood by employees
- An available written routine for locking out energy sources for each machine
- Trained personnel
- Equipment for locking out energy
- Defined and tagged Lockout points for each machine
- An organization with knowledge of the Lockout system and a culture to use the system
- Systematic follow-up

Lockout means physically locking out energy sources in a machine before performing any activities inside the Hazardous Area.
Controlled Risk System
Controlled Risk is a system for reducing the risk of accidents and injuries when working with machines that still have energy connected. Controlled Risk System must be used together with Work Permits.

Only when it is not possible to Lockout the main energies while doing a job can you use Controlled Risk.

Controlled Risk System implies that defined, documented risk-reducing (compensating) measures are prepared when working inside the Hazard Area of a machine while energy is connected.

The risks lie in the possibility that equipment or safety devices may malfunction when someone is inside the hazard area.

This means all risks in any job within the Hazard Area need to be identified.

The risks must then be removed or minimized to an acceptable level, by compensating measures.

Safe Job Analysis (SJA) is the most important tool for carrying out Controlled Risk jobs in a preventative manner.

The main aspects of Controlled Risk are:
- Map operations in Hazard Areas
- If possible, remove the job to a non-hazard area
- Identify and reduce risks by performing SJA/risk assessment
- Devise an energy control procedure for performing the operation safely
- Train personnel
- Use the procedures

Safety barriers for Energy Control may include: physical safeguards, electronic safety devices, lockable safety fences and light beams.

The function of many such devices is based on disconnecting the control current of the machine – note that this means the main current is still connected and still poses a risk for employees.

The use of controlled risk activities should be reduced to an absolute minimum.

Controlled risk system means working on “live” machinery while reducing the risk to personnel through safety measures.

The use of controlled risk activities should be minimized.

If you cannot shut down energy supplies before entering the hazard area, you must reduce risks with the best available safety tools.

Hydro’s requirements for Controlled Risk System are that if you cannot shut down energy supplies before entering the Hazard Area, you must reduce risks by following defined risk reducing (“compensating”) measures. Risk reducing measures must be documented, detailing what has been done and why.

Examples of work that requires Controlled Risk are:
- Machine adjustments/setup
- Jam removal
- Scrap removal

References:
Work at height

Working at height includes all work on or with cranes, crane stretches, personnel lifts, mobile cranes, trucks with baskets, scaffolding, ladders and work on roofs.

Safety devices to prevent personnel from falling are mandatory (and must be specified in the Work Permit).

The most commonly used safety device is an anchored safety harness. Another type of safety barrier is a fixed guardrail.

In order to prevent accidents, strict rules must be adhered to:

- Written routines must be available, outlining the use of lifting devices and safety devices
- Equipment must be approved/certified and tagged as such
- Equipment must be subjected to acceptance inspections at defined intervals (preventive maintenance program)
- A certified person with specific competence in scaffolding should approve scaffolds.
  Written approval must be available for inspection

Personnel who participate in work at height must be trained and certified in using the relevant lifting equipment and safety devices. The training must be documented and must include:

- Knowledge about construction
- Area of application
- Maintenance
- Control - there must always be a rescue plan in place to bring down the person working

Tools and equipment must also be secured to prevent them falling.

When preparing work at height, a Safe Job Analysis (SJA) must be used to assess the risk and define the best safety measures.

Among the critical elements to be considered are the following:

- Is the lifting device certified and checked?
- Is the safety equipment certified and checked?
- Is the anchor-point for the safety-line secure?
- Is the support steady enough for standing on?
- Can you do the job without placing yourself in unsafe positions?
- Do you need to move the support to get a better position?
- Is the ladder or scaffold secured?
- Have you got the right training for the job?
- Can we get the person down quickly if an accident happens?

Important!

If a person is left hanging in a rope/harness for a prolonged period, it will affect the person's circulatory system. Always make sure you have a method for getting the person down safely if anything goes wrong.

Remember:

When working at height:
Always use certified equipment
When using certified equipment, personnel must be certified in its use
Only certified personnel may participate in work at height

Lifting operations require careful planning - risk assessments and good routines. Secure the area below the lifting operation.
Work in confined spaces
A confined space means any place, (including any chamber, tank, vat, silo, pit, trench, pipe, sewer, flue, well or other similar space) which, by virtue of its enclosed nature, presents a reasonably foreseeable risk.

Pay special attention to the following hazards:
- Physical hazards from mechanical equipment or moving parts, such as agitators, blenders, and stirrers
- Risk of being exposed to toxic gases in the container
- Risk of being exposed to gases, liquids or fluids entering the space from connecting pipes
- Risk of other physical hazards, such as heat and noise
- Risk of fire and explosion

Managers must ensure that levels of oxygen, combustibility and toxicity are tested before entry and during work.

Ensure adequate numbers of personnel are available during operations in confined spaces. At least one person must remain outside to monitor conditions, offer assistance and summon help if necessary.

If a situation arises that requires emergency entry, the attendant must not enter the confined space until additional help arrives.

Make sure you have assessed the risks of entering, and made the necessary preparations. Remember to post a guard outside!
Fall Protection
These general guidelines should be adhered to in a job situation whenever there is a risk of falling:

• Make sure there is a guardrail or cover for all open pits, tanks, vats and ditches
• Use guardrails on all walks, runways or platforms 2 meters or more above ground level
• Make sure there are guardrails, toe boards and metallic grating or similar material on engine-powered lifting platforms.
• Use safety lines and harnesses
• Make sure all employees are thoroughly familiar with fall protection equipment, including all its functions.

Secure yourself and equipment with safety harness
TRANSPORTATION

Transportation on Hydro premises
Operating Hydro’s facilities requires a considerable amount of transportation of raw materials, products or personnel. This takes place on the company’s own commercial properties and on public ground – by road, railroad, air or sea.

As manager, you are responsible for ensuring that internal transportation is conducted according to Corporate requirements, legal requirements and those of local authorities.

The process of transporting goods is divided into four activities: loading, securing, transporting, and unloading.

You are required to have a “Hydro Representative” who is responsible for supervising the transportation process as described in NHC-CD04-1-HSE-16. This must be a person who is trained for the job. The person can be one of your own employees or a person who is contracted.

You must ensure Hydro personnel are trained in regulations, and how to handle transported goods. If you use contracted transporters, it is your responsibility to check they satisfy Hydro requirements.

This traffic poses major challenges to daily operations and managers must be prepared to deal with problems such as:

- Hazardous substances/chemicals (see above)
- High-temperature vehicles
- Limited space for regulation of traffic
- High vehicle density
- Loading and unloading
- People and vehicles in the same area
- Large and heavy vehicles

Transportation of dangerous goods
Every day at Hydro facilities, chemicals, explosive substances, toxic substances, liquid metal, metal products and other products are transported. In short, many dangerous substances are moved inside the plant area.

An emergency plan for transporting chemical goods is needed. When transporting “high consequence dangerous goods”, a security plan is required according to ADR/RID regulation. “High consequence dangerous goods” are those which have the potential for misuse by terrorists and as a result produce mass casualties and serious material damage.

Remember that storage is also part of the transportation process. You must ensure correct storage conditions. Some goods must not be stored together because they may react and produce toxic substances or explosive conditions. Training and correct labeling are important preventative elements.

When transporting dangerous goods by road or rail in Europe, a Safety Advisor is required. This person should be used actively in order to ensure compliance with regulations. All managers must be aware of similar legal requirements at their location.

Major causes of transportation accidents at Hydro

Operation of mobile equipment
- Driving faster than speed limits
- Overloading the vehicle
- Being influenced by drugs or alcohol or when excessively tired
- Using handheld telephone while driving
- Personnel not seated in manufacturer-provided seats
- Unauthorized lifting platforms or fork attachments
- Accessing equipment with three points of contact
- Leaving mobile equipment unattended with the engines running

Inappropriate handling of mobile equipment
- Unsecured or imbalanced loads
- Working under suspended loads

Pedestrians
- Pedestrians not yielding to equipment
- Vehicle operator unaware of pedestrians

Transportation of dangerous goods

Loading
Securing
Transporting
Unloading

All phases of transportation have the potential for accidents.
Establishing site traffic regulations

The logistics of managing traffic within an operational area are a real challenge.

This can be dealt with by analyzing the traffic picture, devising local regulations and routines and then establishing a culture for safe transport.

Important elements in establishing local traffic regulation are:
- Performing a hazard assessment (traffic assessment)
- Prioritizing methods for protecting pedestrians
- Making separate pedestrian walkways and routes for mobile equipment
- Clearly marking different routes (color coding)
- Putting up signs and warning devices
- Developing site-specific traffic regulations for mobile equipment and pedestrians.
- Establishing control of all mobile equipment
- Training employees and external personnel
Driving externally
In some cases, we need to drive a car or another vehicle in normal traffic as a part of our job. Part of demonstrating a commitment to HSE standards as a manager involves safe driving techniques, even if this is only to and from your place of work.

Driving outside the company premises should be as safe as when doing any other part of your job. This may require that the driver is extra watchful and drives defensively. We do not control the attitudes and actions of other drivers, but Hydro drivers should drive carefully.

When driving in another country, it is likely employees will encounter other customs and driving cultures. Guidelines for driving in other countries are:

- Safety belts must always be used, both by driver and passengers
- Driving under the influence of drugs or alcohol is prohibited
- Limit your speed when local limits do not provide the necessary safe driving conditions

Specific restrictions concerning driving in the dark must be taken in high-risk areas

If you need to hire a driver in another country to visit Hydro or customer facilities, the following requirements apply to the driver. The driver:

- Should be employed by an authorized driving company, if not employed directly by Hydro
- Should have appropriate documented training and experience
- Should demonstrate a defensive driving attitude and, if available, have completed an approved defensive driving course
- Should be able to document a good safety record
- Must have some English language skills
- Must use shift cycles, duty hours and have regular rest periods

Merging into traffic in a foreign place with an unfamiliar car may provide risks that are difficult to foresee. Be patient, and make sure that you are not creating a dangerous situation.

Hydro’s driving checklist:

Before departure:
- Plan the journey with sufficient time
- Check you have all necessary documents
- Check the condition of tires, lights, windows
- When driving in extreme heat or cold be prepared. Bring liquids, food and a shovel
- When using a rental car, take time to familiarize yourself with the controls
- Secure loose objects to avoid injuries after abrupt braking
- When driving abroad on the “wrong side” of the road, check for alternative means of transportation

While traveling:
- Use seatbelts where they are provided in taxis and buses
- Use a headset if using a mobile phone or, even better, pull over
- Abide by speed limits and adjust your speed to weather conditions
- Communicate your concerns to the driver if he/she is reckless
Assess risks and implement barriers to secure Hydro’s personnel, assets and sensitive information. Manage crisis at all levels by good planning and training.

Security involves protective measures against:
- Actions that may harm Hydro’s personnel, assets, activities, reputation or interests
- Loss, theft, or improper use of information, material, equipment or similar

Security incidents may lead to serious harm to our personnel, assets, production capability, or lost business opportunities and damaged reputation. One of Hydro’s competitive edges going forward is linked to securing sensitive processes and information.

We must pay greater attention to security matters, due to increasing risks and crime in general. Security measures must be an integrated part of the planning and operation of all Hydro activities.

Some of the information and competence that Hydro possesses, develops, receives and communicates, is highly valuable. This information is used for instance to operate facilities of importance for the company and gain new market opportunities.

Security Management
Security is a line management responsibility and must be included in planning and operations for each unit and projects.

Line management should ensure that the appointed HSE/Security Manager has the necessary support and competence available as well as the means to carry out security duties.

Line managers must provide for:
- Necessary competence on security
- Security assessments with regular updates
- Adequate security measures
- Supervision

Establishing security measures in an organization for the first time should be run as a project. Please see the Appendix in this handbook which provides guidelines for operative security.

Events
When meetings and events are arranged outside Hydro premises, adequate measures must be taken to cover all HSE issues (e.g. information security, securing personnel, fire safety, first aid, emergency preparedness).

Threat and Vulnerability Assessment (TVA)
A TVA is the basis for security planning and measures. The assessment should be carried out for all activities every three years and updated once a year. The update should be based on changes in threat factors, probabilities or consequences. If the activities are located in medium- or high-risk areas, the assessment should be carried out more frequently. Adequate professional resources should be consulted.

The threat level must be monitored to cope with rapid changes – how to ensure this is done should be assessed in the TVA.

Examples of security threats for Hydro:
- Unauthorized access to property
- Disloyalty
- Misuse of alcohol/drugs
- Unidentified objects in the logistics chain
- Blackmail
- Violent activists
- Robbery
- Arrest
- Missing person(s)
- Sexual assault
- Vandalism
- Bomb threat
- National conflict
- International conflict
- War
- Sharing premises with external companies
- Bugging/monitoring/surveillance
- Transportation-related incidents may also be considered security threats

Security breaches, attempted breaches or suspicion of such must be reported through line management without delay.

The threat and vulnerability assessment must be updated annually to assess the adequacy of the security levels and measures in place.

Security threat

- Industrial espionage
- Sabotage
- Kidnapping
- Terrorism
- Data crime
- Corruption
- Burglary
- Ransom
- Destruction
- Theft
- Violence
- War
- Sharing premises with external companies
- Bugging/monitoring/surveillance
- Transportation-related incidents

Examples of security threats for Hydro:
The TVA process
Appropriate specialized resources should be consulted, such as local police or security specialists. HSE managers can provide help and assistance in identifying resources to provide input.

Personnel security
Security-related factors must be taken into account before employing or reassigning a person to positions with access to sensitive information.
- Is the person competent to manage risks listed in the TVA section above?
- Does she/he have the necessary attitude to act in accordance with Hydro’s values and integrity?

Employees and temporary staff are bound to secrecy in all business affairs in which provision of information to others may harm Hydro. This obligation to maintain confidentiality must be acknowledged by means of a written confidentiality agreement, and remains binding after termination of employment in Hydro. Line managers are responsible for ensuring that confidentiality agreements are in place, in cooperation with the local HR department.

Line managers should follow-up security related issues in confidential conversations with employees. These may be regarding work-related hazards or issues of a private nature (e.g. wrongful behavior on the part of other employees, criminal acts or threats, drug problems or major financial problems. See threats listed in the TVA section above).

Security training
Line managers are responsible for providing all personnel with necessary security training and information. Relevant standard topics as well as local procedures should be presented.

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<tbody>
<tr>
<td>(E.g.)</td>
<td>Local HSE documentation</td>
<td>Hydro (e.g.): Local management, HR, IT/IS, maintenance, emergency response personnel</td>
<td>Fill out the TVA form and make a report, describing main risks and recommended measures to be implemented.</td>
<td>Implement approved measures</td>
<td>Follow up and control that approved measures are implemented and functioning according to plan</td>
</tr>
<tr>
<td>HSE manager Line manager Other relevant personnel</td>
<td>- Risk assessments NH standards Public requirements</td>
<td>External (e.g.): Established companies, Landlord, Ministry of foreign affairs, Emergency service</td>
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ID/access cards
Employees and temporary staff should be provided with an ID/access card, which indicates their category of employment. The ID card should be worn in a visible place whenever possible.

Managers are responsible for approving and regularly assessing personnel access to their area. Upon termination of employment, ID/access cards, keys and all Hydro materials must be returned. User identification and passwords to computers must be cancelled immediately.

Temporary staff and suppliers
The local manager is responsible for the implementation of the necessary security measures, and must in particular ensure that:
- Confidentiality agreements are signed
- Relevant security requirements are explained
- Access to classified information and documentation is given only if this is necessary for carrying out work
- Access to areas is permitted to the extent necessary to carry out work and within normal working hours, unless special circumstances require otherwise
- Suppliers ensure that sub-contractors are subject to the same security procedures
- If confidential information is handed over to a contractor for destruction, there should be frequent audits of the contractor. It should also be ensured that any such documents are properly secured during storage, transport and destruction.
Contracting security guards
In operations or units where security guards are contracted, measures must be in place to ensure that the “Voluntary Principles on Security and Human rights” are followed.

Requirements and instructions for security guards must be agreed upon with the relevant contractor and local labor unions, as appropriate.

Information security
A major part of Hydro's value and business strength lies in the expertise we have built up over time. This might be information dealing with procurement processes, project management, competence or other sensitive information.

Line managers are responsible for the security of their information during all phases of its handling. This includes being aware of someone listening to your conversations, being aware of what information you share with others or installing secure cabinets.

The following are basic security information measures:
• Encryption of e-mails
• Screen filters (to prevent people reading your screen over your shoulder)
• Secure USB sticks
• Secure print function

Information security outside Hydro's premises
Hydro is especially exposed to information theft and leakage because we have not been accustomed to having many security measures at our facilities until now. Special precautions should be taken to avoid loss of confidential information.

Internal information should be kept in a secure environment when not guarded (for instance, at home or in a hotel room).

Confidential information
Written information should be kept in a secure environment, when not guarded
• At home, there should be storage cabinets of good quality that only you have access to
• At hotels, information can be kept in the hotel safe
• The information must be carried as hand luggage when traveling on public transportation
• The information must be shredded by a cross-cut machine or burned when being disposed

Especially sensitive information
• Information on a Hydro PC with approved encryption (Safe Guard Easy) can be stored at home and in hotel rooms if the PC is turned off
• At home, documents should be stored in a secure cabinet
• During travel, information should be guarded at all times. If possible, avoid traveling with this kind of information

Orally
Conversations referring to sensitive information should be avoided in public areas and conducted in a safe manner to minimize the chances of unauthorized personnel listening in. Be aware of others' attempts to socialize with you in order to gather sensitive information (e.g. competitors and journalists).

Visibility
The information should not be accessible to unauthorized personnel - don't read on planes and avoid public areas such as hotel restaurants.

Personnel security measures must annually be checked for conformity with the current threat and security level.

Our own personal behavior accounts for 90% of security risks facing Hydro. Careless behavior includes:
• forgetting to collect from printer
• forgetting to shred sensitive papers
• forgetting to lock computers
• talking in public places about sensitive personal or business information
• forgetting to remove "track changes" and comments from documents sent outside the company

References:
Information security standard CD11-01-App 2
Asset security
Access to sensitive information and operations must be defined and limited appropriately, based on the established Threat and Vulnerability Assessment (TVA).

Security levels with minimum requirements are defined in the Corporate HSE standard CD04-1-HSE-10 Security. Additional descriptions and guidelines are found in the Appendix - Security Manual.

Security level 1
Covers areas where free access is not permitted. Admittance of unauthorized personnel could represent a danger or inconvenience to the company's activities (e.g. general factory areas, quay areas and offices with non-sensitive activities).

Security level 2
The activities in the area are normally of such a nature that sensitive information may be accessible. Admittance of unauthorized personnel may present the risk of compromising sensitive information (e.g. factory areas and offices).

Security level 3
Sensitive processes or information are regularly handled or stored in this area. Admittance of unauthorized personnel may represent a danger to the company, employees or business partners (e.g. research activities, offices with sensitive information, sections of computer areas, and computer/ communication cabinets).

It is recommended that the different security levels for the facility are marked on a map or floor plan and kept confidential. The following color codes should be selected:

- Security level 1: Green
- Security level 2: Yellow
- Security level 3: Red

Logistics security
Secure packing, transportation, reception and storage of materials must be adhered to where relevant. In risk areas special arrangements to monitor access and movement of personnel must be in place. Security requirements for transportation and forwarding companies should be formalized. All leased and owned means of transport should be properly secured when not in use.

The threat and vulnerability assessment must be updated annually to assess the adequacy of the security levels and measures in place.

Non-conformity with corporate security standards must be reported - together with an explanation - through the line management, who will seek approval (from Corporate HSE if deemed necessary).

References:
HSE standard CD04-1-HSE-10 Security
HSE standard CD04-1-HSE-17 Business travel in Hydro
HSE standard CD04-1-HSE-05 Emergency planning
HSE procedure CD04-01 Hydro HSE Management System
NHC-CD11-01-App 2 - Information security standard
NHC-CD01 - Hydro's Business Principles
NHC-CD03 - Hydro's People Policy
NHC-CD05 - Hydro's Code of Conduct
NHC-CD07 - Deployment of Capital
NHC-CD10 - Risk Management
NHC-CD12 - Hydro's Social Responsibility
Appendix C – Security Manual
The Challenges
In this section you will find information concerning the way we think and work systematically to minimize our impact on the environment (Hydro’s “environmental footprint”).

Like other companies working with raw materials, Hydro faces major environmental challenges, such as climate change and challenges relating to issues such as biodiversity, water use, emissions and waste management.

Hydro believes climate change requires action now in order to reduce global CO2 and other greenhouse gas emissions. Our own particular challenge is the result of the relatively large climate gas emissions associated with aluminium production. Our internal Climate Change Network has been tasked with identifying measures that will improve our performance. Corporate HSE can provide specific advice on climate change, including how to communicate Hydro’s response.

The growing reduction in biodiversity and scarcity of water globally are also particular challenges for us since we rely on the availability of land and water resources for key inputs into our operations.

Environmental management and Hydro
In 1987 the Brundtland Commission (formerly known as the World Commission on Environment and Development, under the UN framework) defined sustainable development in their report “Our Common Future” as:

“about meeting the needs of the present generation without compromising the ability of future generations to meet their own needs”

Our response to this is:

“Hydro’s mission is to create a more viable society by developing natural resources and products in innovative and efficient ways.”

As one of the global leaders in the aluminium industry, we know that the production, fabrication and recycling of aluminium has an impact on our environment. At the same time we can supply environmentally sound applications to the market, and this supports a more environmental friendly development.

Our ambition is to be among the leading companies in the world in terms of processing natural resources with the least possible impact on the environment.

Our aim must therefore be to minimize our environmental footprint (our environmental impact) throughout our value chain.

With natural resources becoming scarce and with greater public scrutiny with regard to efficient energy use, our future success as an aluminium company will depend on our ability to remain at the forefront of the sector in terms of sustainability.

It is for this reason that you as managers have an important role to play in ensuring our environmental performance is as high as possible.

In order for us to stay at the forefront of the industry it is important that you address these issues as systematically as other HSE elements and support the drive to minimize our overall environmental footprint.

Managers must try to use the best available technology, and integrate environmental protection into day-to-day operations, as well as design processes to achieve better, cleaner and more efficient production.

Environmental goals are set periodically for the entire company. At the same time we measure our performance, in order to track our progress and improvements on an annual basis.

The UN Millennium Ecosystem Assessment from 2005 (http://www.maweb.org/en/index.aspx) as well as the Intergovernmental Panel for Climate Change (IPCC) (http://www.ipcc.ch) have documented the global challenges. Hydro is playing its part in tackling them.

Hydro policy:
With respect for energy and resources, invest in innovation so our activities and products have a minimum adverse impact on the environment.

Starting small for the environment:
There are many small steps that employees can take to help save energy and carbon emissions. For example:

- Turn off lights, monitors and computers when they are not in use
- Use telephone or video conferencing as an alternative to travel
- Set printers to use both sides of the page by default
- Stop using disposable cups

HSE policy
We will continuously work to reduce environmental impacts and risks related to our activities (NHC-CD04).

The Annual Action Plan for the Environment must be based on a prioritized list of the significant environmental challenges that exist in your organization.
Good environmental management is about realizing that we have a role to play in contributing not only to building a successful company but also to our stakeholders’ social, economic and environmental wellbeing. Being a good corporate citizen is about:

- Complying with our corporate policies, standards and internal business plans where we set objectives for systematic environmental improvement
- Complying with regulations and permit conditions
- Operating in harmony with our neighbors - avoiding/minimizing negative environmental impacts
- Demonstrating transparency with regard to our operations and their overall impact - maintaining a good and open dialogue with our stakeholders and neighbors
- Making systematic progress with regard to environmental performance
- Contributing to sustainable production and products while focusing on the whole lifecycle of the products and production process.

Our partners will more readily regard Hydro as a preferred partner if we ensure our ambitions are matched by concrete progress. Some of the benefits of this might be:

Ensuring access to energy or bauxite resources that are vital for Hydro’s long-term success

Maintaining our license to operate in existing plants despite stricter legal requirements and less stakeholder acceptance of emissions

Acquiring licenses for greenfield projects (operating in areas where they have no experience with our industry)

Our environmental management system

The implementation of environmental management requirements in Hydro is described in the following sections.

The Environmental Management System ISO 14001 is based on the generic planning model PDCA - Plan, Do, Check, Act (see page 37). This is the same model that is applied to other parts of Hydro’s HSE management system (NHC-CD04-01).

There is no common standard or process description to identify significant environmental challenges in Hydro but the following steps generally apply:

Identify all relevant activities, services or products and their environmental aspects:

Assess all identified environmental aspects and carry out environmental risk assessments. The risk assessment should consider both:

- Short term (reversible/irreversible) impacts (e.g. accidental emissions/spills of hazardous chemicals)
- Long term (reversible/irreversible) impacts (e.g. emissions of CO₂ or discharge to waters of persistent organic pollutants (POPs)

When it comes to energy efficiency, the typical values range from only 45 percent to approximately 50 percent. This is the part of the energy added to the cell, which is used to produce aluminium. The rest of the energy produces heat, which is lost from the cell.

A natural second step is therefore related to recovery of energy from the main heat loss sources, like cathode linings and gas exhaust systems. Hydro is pursuing technological solutions to collect heat from various parts of the aluminium cell, as well as being able to convert heat into electricity, as a long-terms scenario.

A third step may be CO₂ gas cleaning related to the electric power generation. And finally, collecting and cleaning CO₂ from the reduction process itself. Even this may be a technically possible future scenario. Making the off-gasses from the reduction process capturable is a goal, and Hydro is progressing on solutions for this, even though cooperation with partners and suppliers is central to reach full capture and storage solutions for the future.

References:

Directive NHC-CD04
Procedure NHC-CD04-01
Standard NHC-CD04-01-HSE-09 - Product stewardship
Standard NHC-CD04-01-HSE-18 - Environmental management

Hydro’s main requirements governing environmental management are defined in our HSE directive, and in the procedure on the HSE management system:

- Ensure compliance with the environmental management system ISO 14001 standard or equivalent
- Ensure compliance with regulatory requirements
- Implement risk-based environmental management
- Standards are set for registration of relevant data, reporting of incidents, and management of environmental aspects including product stewardship

The first step – and ongoing challenge – of the aluminium industry is to focus more on lower specific energy consumption, and eliminate the anode effect frequency, as a main contributor to green house gasses from our operations. Extensive technology programs are set up both to improve existing procedures and develop new process control technology, aiming for increased energy efficiency and benchmark GHG emissions.
An environmental aspect is an activity, product or service that can impact the environment.

A significant environmental aspect is an environmental aspect that has or can have a significant environmental impact.

An environmental impact is a change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization’s activities, products or services.

Identify all relevant regulatory requirements, both existing and emerging. Environmental management is governed by regional, national and global requirements and is one of the most demanding aspects of HSE management. In Europe, EU Affairs can help keep you up to date with the latest rules - please see the EU Portal on the Intranet. In other parts of the world, please contact Corporate HSE for advice. Another source of information is the European Aluminium Association (EAA).

Identify the issues likely to be of interest and/or identify the expectations of third parties, such as local community leaders, local and regional authorities, the media and non-governmental organizations (NGOs). Corporate HSE can help with this task.
The table above lists activities, environmental aspects, and environmental impacts to be considered. However, the generic table above must be adapted to local operations and conditions.

<table>
<thead>
<tr>
<th>Activities</th>
<th>Environmental aspects</th>
<th>Environmental impacts</th>
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<tbody>
<tr>
<td>• Business activities (including modifications, new projects/ major expansions, mergers, acquisitions, sales and close-downs)</td>
<td>• Emissions to air</td>
<td>• Climate change</td>
</tr>
<tr>
<td>• Production including shutdown and start-up conditions, abnormal operations and potential emergency conditions</td>
<td>• Discharges to water (seawater, freshwater and groundwater)</td>
<td>• Changes in biodiversity</td>
</tr>
<tr>
<td>• Supplier aspects</td>
<td>• Land use and contamination</td>
<td>• Chemical persistence/ bio-accumulation/ toxicity</td>
</tr>
<tr>
<td>• Local community (including liability management)</td>
<td>• Waste generation: incineration; depositing; reuse/recycling</td>
<td>• Resource depletion</td>
</tr>
<tr>
<td>• Storage</td>
<td>• Use of natural resources (energy, raw materials, fresh water, land areas)</td>
<td>• Odor</td>
</tr>
<tr>
<td>• Transportation and logistics office</td>
<td></td>
<td>• Dust (particulate matter)</td>
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<td></td>
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<td>• Acidification</td>
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<tr>
<td></td>
<td></td>
<td>• Ozone depletion</td>
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</table>

Emissions/ discharges may be any of the following:

• chemicals
• biological agents
• light/radiation/radioactivity
• noise and vibrations
• thermal energy

Each unit’s management team shall routinely review the environmental aspect list.

Such reviews must be carried out at least annually and as part of making the yearly action plan or when:

• Significant changes occur to existing activities, products or services
• Corporate or sector environmental requirements changes
• Legislation changes
• Audit results are presented
• New knowledge about environmental impacts is available
The annual action plan for a site should as a minimum address the following issues:

- Energy consumption and efficiency
- Raw material management
- Greenhouse gas emissions
- Waste management and minimization
- Water management
- Biodiversity
- External emissions, such as noise and dust

You should set targets/environmental KPIs that fulfill Hydro’s objective of continuous improvement. If your Business Area has established environmental KPIs, these should be used at all times.

When planning for business activities such as new projects or major brown field expansions, (in areas of existing industrial activity) special attention must be paid to completing the Environmental Impact Assessment (EIA).

The Environmental Impact Assessment is a method of outlining our plans and risk management methods for both internal and external audiences. The EIAs cover all likely environmental impacts, including emissions of greenhouse gases, impact on biodiversity and water use. Remember that external groups provide vital input to the relevant authorities with regard to construction or operating permits.

In mergers, acquisitions, sales and closures, environmental studies are carried out by Corporate HSE. The main objective is to identify short and long term risks and their associated costs. These studies then form the basis for action plans after takeover or closures.

It is generally the responsibility of managers at higher organizational levels to verify that all necessary studies such as Environmental Impact Assessments are completed. As managers, you must ensure that these have been carried out.

“Green” operations
A production system that operates without unplanned interruption normally performs well from an environmental perspective.

Making sure that there are few technical failures will minimize the risk of accidental emissions and ensure that existing permits are complied with.

However, it is vital that maintenance systems include prevention and control of spills from our machines and storage areas. Good control and maintenance routines must also be in place for abatement systems.

Reporting
All units in Hydro must, as a minimum, measure, monitor and report to higher organizational levels the following:

1. **Environmental data** – using the system as required in HERE (The Hydro Data Software for Registration and Reporting Energy, Resources and Environmental Data).
2. **Environmental incidents** – using the system as required in SYNERGI (see NHC-CD04-01-HSE-02: HSE incidents and sick leave data). Points to remember:
   - Environmental incident categories include discharges to the external environment, leaks, permit breaches and environmental complaints.
   - Note that classification of “environmental severity” must follow the classes defined by each Hydro sector.
   - If environmental incidents do occur, they must be investigated, analyzed and followed up in accordance with the Corporate HSE standard Analysis, Investigation and Follow-up of Accidents and Incidents (NHC-CD04-01-HSE-03).
3. **Environmental permits**
   Public authorities often define reporting requirements in the operating permit for a Hydro site. Normally this results from ongoing monitoring of emissions, discharges and external noise emissions, as well as production, consumption of raw materials and waste and chemical management data.

   There are often reporting requirements from other Agencies besides those defined in the permit. It is vital that you hold an updated overview of these and comply accordingly. Any breaches must be reported to line management and Corporate HSE immediately.

**Hydro Policy**
We will design our products, develop and use technology to produce minimum adverse effects on the environment, making efficient use of energy and resources (NHC-CD04)

In order to achieve the best possible balance between maintenance efforts and plant reliability and safety, the production system must be evaluated and the equipment and systems classified under three or more main categories.

The criticality consequences on safety and environment shall be based on the HSE policy.
(NHC-CD04-01-HSE-12).

References:
- NHC-CD04-01-HSE-01: Registration of environment, resource and energy data
- NHC-CD04-01-HSE-02: HSE incidents and sick leave data
- NHC-CD04-01-HSE-03: Investigation and Follow-up of Accidents and Incidents
Product stewardship

Product stewardship is defined as the “responsible and ethical management of the health, safety and environmental aspects of a product throughout its total life cycle”.

The objective of product stewardship is to:

- Prevent injury to human health and damage to the environment by continuously assessing risks associated with all phases in a product’s life cycle
- Improve product design, risk assessment practices, advice, information, and customer support
- Meet standards and expectations for consumer goods in terms of legal requirements, and customer and stakeholder expectations. This is vital for market success.

The following is an overview of Hydro’s main requirements during the different phases of a product’s life cycle:

- **Design and development of products, and alterations of existing products**
  - Seek to develop products that pose minimal HSE risks when they are handled and used by our customers

- **Raw materials management**
  - Assess HSE risks prior to purchasing new raw materials, and/or when entering into new agreements with suppliers of raw materials

- **Production**
  - Carry out benchmarking studies of manufacturing processes against the Best Available Technology (BAT), where available
  - Establish standards for product specifications and product quality, and ensure that all deliveries are in compliance with these standards
  - Establish systems to ensure that products are in compliance with regulatory requirements

- **Storage and transportation**
  - Storage of hazardous materials is described in HSE standard “Storage of hazardous materials”
  - Transportation of dangerous goods is described in HSE standard “Transportation of dangerous goods”

- **Handling and use of products**
  - Establish a system for customer support to provide advice on safe storage, transportation, handling, use and disposal of products, and to handle questions and complaints

- **Waste management and recycling**
  - Establish procedure for waste management, including a system for waste classification
  - Assess reuse/re-cycling of products and waste

Examples of product regulatory requirements:
- Classification and labeling
- Safety Data Sheets
- Restrictions on marketing and use of certain dangerous chemicals

References:
- Product stewardship: NHC-CD04-HSE-09
- Storage of hazardous materials: NHC-CD04-HSE-06
- Transportation of dangerous goods: NHC-CD04-HSE-16
Chapter 4 notes
This chapter presents our systems to follow up HSE performance at Corporate, Sector and Unit levels.

In Hydro, HSE activities are systematically followed up according to the PDCA principle (Plan, Do, Check, Act). Necessary corrective and preventive actions are implemented; both at the individual employee level and on a higher, formal level.

To live our values we will:

- Remain a valued partner through our strong performance on health, safety, security and environment
- Ensure continuous improvement in all our activities
HSE management system audits

Production sites are required to be in compliance with ISO 14001 or equivalent and are required to establish an audit program and audit procedures. If a site is not ISO certified, the top management must be satisfied that similar audit programs are in place.

The objective and extent of audit programs should be based on considerations of risk, non-conformance, lack of goal achievement and reorganization.

Presidents HSE award

It is important that we have good examples within the company to encourage further improvements for other units. Unfortunately, we still experience serious incidents, which underline the need for further improvements. We see clearly the value of a systematic risk based approach and the involvement of our employees and contractors as a basis for further improvements.

Although the President’s HSE Award is given to one unit only, it is meant to symbolize our recognition of the efforts of all employees throughout the company who are committed to making Hydro a better place to work. This broader recognition is achieved through the awareness, the competition and the prestige that accompany the selection process. It is expected that all sectors will widely publicize the invitation for the Award and will nominate one of their units.

Purpose of the Award:
• Stimulate continuous improvement in HSE
• Enhancement in HSE work
• Exchange experience and working habits in the Company
• Recognize commitment to HSE
• Stimulate winners. Thanks to all employees for excellent performance
• Create competition between units

Attention will be paid to all HSE elements concerning commitment, compliance, risk management and performance. It is a prerequisite that the nominated unit is in compliance with Hydro requirements and have had no major accidents in the preceding year. Score is given for the following topics: General, Safety, Health and work environment, Security and Environment.

Corporate follow up

A Corporate HSE audit system is in use at the Sector/ Business Unit Level.

The audit is carried out by Corporate HSE every third year.

The audit model consist of fourteen elements:
• HSE policy and strategic goals
• Investments and divestments
• Purchasing controls
• Product stewardship
• Objectives, performance indicators and targets
• Structure and responsibility
• Management training
• Operating procedures
• Change management
• Emergency preparedness
• Security
• Accident/incident investigation, follow-up, analysis and reporting
• Communication and promotion
• Program monitoring and system auditing

In addition a corporate HSE audit group performs audits on selected plants/sites, based on a yearly plan. Six to eight audits are performed per year.

Overview of typical audit activities

Initiate the audit
Prepare audit (documents)
Conduct on-site audit activities; interviews, inspections and verifications
Prepare and distribute the audit report
Conduct audit follow up

The Organization shall organize and implement periodic HSE audits of its own, and of lower organizational levels’ HSE management systems, using recognized audit tools.

The Organization shall periodically review its HSE strategy, its HSE management system, and their effectiveness, including making a self-assessment statement.

Compliance and self-assessment will be verified by Corporate through audits. Under-performers will be followed up with specifically. Every organizational unit must carry out periodical internal audits. All levels of the organization must be revised. Such audits must be implemented at 3 – 5 years intervals, using recognized audit tools.

Corporate follow up
Sector follow-up

Management review / Self Assessment

Sector level senior line management must have an overall understanding of local risk exposure. Key risks must be identified and preventive measures put in place to control them.

“The HSE Self Assessment Process” to be carried out two times a year, combined with quarterly review meetings and the Corporate audit process is the mechanism to be used to achieve this.

A “Self-Assessment Checklist” is designed.

The results of the assessment are reported to Corporate HSE staff who summarize the key findings at Sector level and present the status to the Corporate Management Board.

A letter from the President and CEO recognizes units with very good HSE performance over a long period. Alternatively, a letter from the President and CEO will underline the need for improvements in Units with substandard HSE performance over a long period.

Under performance

A unit’s compliance with prevailing requirements and its self-assessment will be verified by the Corporate HSE staff through the Corporate Audits. Special support and follow up will be given.

Important subjects on the Self Assessment Checklist:

- Risk
- Objectives, performance and targets
- Action plans
- Competence and training
- Operational control
- Modifications
- Emergency preparedness
- Contractors and suppliers
- Maintenance program
- Non-conformances, corrective and preventive actions
- Auditing

Overview of typical audit activities

- Initiating the audit
- Prepare audit (documents)
- Conduct on-site audit activities, interviews, inspections and verifications
- Prepare and distribute the audit report
- Conduct audit follow up
Chapter 5 notes
# 6 Terms and definitions

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<th>Terms</th>
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<tr>
<td>5S</td>
<td>46</td>
<td>Part of (TPM) improvement processes, The 5 key words Sort, Segregate, Shine, Sustain and Standardize translated from a Japanese technique of organizing a workplace.</td>
</tr>
<tr>
<td>ALARP concept. As Low As Reasonably Practicable</td>
<td>33</td>
<td>Systematic and documented process to reduce any risk to an acceptable level.</td>
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<tr>
<td>BBS (Behavior Based Safety)</td>
<td>27</td>
<td>An approach to safety that focuses on workers’ behavior as the cause of most work-related injuries and illnesses.</td>
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<tr>
<td>Biodiversity</td>
<td>81</td>
<td>Variation of life at all levels of a biological habitat. A measure of the relative diversity among organisms present in different ecosystems.</td>
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<tr>
<td>CEO</td>
<td>4</td>
<td>Chief Executive Officer.</td>
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<tr>
<td>Confined Space</td>
<td>72</td>
<td>A space that has limited or restricted means of entry or exit, but is large enough for a person to enter and perform assigned work.</td>
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<tr>
<td>Spaces of this kind may include, but are not limited to, underground vaults, tanks, storage bins, pits and diked areas, vessels, sewers, and silos.</td>
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<tr>
<td>Corporate Emergency Team</td>
<td>49</td>
<td>HSE president with staff</td>
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<tr>
<td>Corporate Steering Documents</td>
<td>30</td>
<td>The Hydro principles of leadership and governance are laid down in Hydro’s Corporate Steering Documents. The requirements in these documents are mandatory for all parts of Hydro and all employees.</td>
</tr>
<tr>
<td>Energy Control</td>
<td>68</td>
<td>See Lockout</td>
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<tr>
<td>EPP</td>
<td>47-49</td>
<td>Emergency Preparedness Plans. Plans must be prepared and maintained for dealing with the full range of emergency conditions which can be envisaged.</td>
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<tr>
<td>HAZOP Hazard and Operability Assessment</td>
<td>61</td>
<td>A tool to identify design weaknesses that might cause serious accidents or operating problems. The HAZOP analysis technique uses a systematic process to identify possible deviations from normal operations and ensure that appropriate safeguards are in place to help prevent accidents. The HAZOP technique uses special adjectives (such as “more,” “less,” “no,” etc.) combined with process conditions (such as speed, flow, pressure, etc.) to systematically consider all credible deviations from normal conditions. The adjectives, called “guide words”, are a unique feature of HAZOP analysis.</td>
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<tr>
<td>HERE</td>
<td>85</td>
<td>Hydro’s data software for the Registration and Reporting of Energy, Resource and Environmental Data.</td>
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<td>HLDP Hydro Leadership Development Process</td>
<td>58</td>
<td>A tool for target setting, performance appraisal and development for employees in Hydro.</td>
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<td>HLDP is closely linked to business planning and builds on our People Policy as well as the Hydro Way.</td>
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<tr>
<td>HSE Health, Security, Safety and Environment</td>
<td>4</td>
<td>For this particular handbook Security is also included and dealt with as part of the HSE term.</td>
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<tr>
<td>HSE Barrier</td>
<td>36</td>
<td>A number of functions or measures to stop an unwanted hazard or accident. Each barrier must function independently of the others.</td>
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<td>HSE Culture</td>
<td>21,23</td>
<td>Knowledge, values, norms, ideas and attitudes related to HSE that characterize a group of people. Central characteristics are:</td>
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<td>Visible commitment</td>
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<td>Deviation Management</td>
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<td>Line responsibility</td>
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<td>Continuous learning</td>
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<td></td>
<td></td>
<td>Focus on human behavior</td>
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<tr>
<td>HSE elements</td>
<td>17</td>
<td>Health and work environment, Security, Safety and Environment</td>
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<tr>
<td>HSE management</td>
<td>13</td>
<td>The sum of all activities connected to the total management task that determines HSE policies, goals and responsibilities. Implement them by systematic planning, organizing, supporting and improving.</td>
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<td>Hydro's general HSE philosophy</td>
<td>6</td>
<td>All injuries can be prevented, and HSE is a line manager's responsibility.</td>
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<tr>
<td>ISO 14001</td>
<td>82</td>
<td>The ISO 14000 series contains a number of international standards on environmental management. It provides a framework for the development of both the system and the supporting audit program.</td>
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<td>KPI Key Performance Indicators</td>
<td>8</td>
<td>Measuring parameters to help an organization define and measure progress toward organizational goals.</td>
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<td></td>
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<td>Once an organization has analyzed its mission, identified all its stakeholders, and defined its goals, it needs a way to measure progress toward those goals. Key Performance Indicators are those measurements.</td>
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<td>Lockout (previously referred to as LOTO in some parts of Hydro)</td>
<td>69</td>
<td>A system to make sure that all energy has been disconnected from a machine, so that the machine cannot start, or parts move. Fatal accidents have often been the result of not having adequate control over energy in the plant (such as electrical power, hydraulic or pneumatic pressure, heating surfaces and potential energy) during maintenance or inspection.</td>
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<td>LTI-rate Lost Time Injury rate</td>
<td>8</td>
<td>Often called H1.</td>
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<td></td>
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<td>This rate is the number of injuries per million man hours worked for the relevant period.</td>
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<tr>
<td>OHS Occupational Health Services</td>
<td>55</td>
<td>Covers the physiological and psychological wellbeing of persons engaged in work.</td>
</tr>
<tr>
<td>OEL Occupational Exposure Limit</td>
<td>67</td>
<td>Exposure limits for chemicals in the workplace within the framework of chemical agents and carcinogens at work. It gives information on toxicological and other relevant properties of chemical agents, and the relationship between the health effects of the agents and the level of occupational exposure. It defines limits which will protect workers from chemical risks.</td>
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<tr>
<td>Override control system</td>
<td>64</td>
<td>Essential for controlling the interlock system and keeps the technical installation in a safe condition.</td>
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<tr>
<td>P&amp;ID</td>
<td>61</td>
<td>Also defined as Process and Instrument Diagram. A schematic diagram showing piping, equipment and instrumentation connections within processing units in chemical plants, power stations and the like.</td>
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<tr>
<td>PDCA</td>
<td>37</td>
<td>A problem solving principle used in Hydro that is simple and easy to understand. It ensures thorough analysis and implementation of all HSE measures.</td>
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<tr>
<td>PDCA Concept</td>
<td>37</td>
<td>The plan–do–check–act concept is a four-step model for controlling an activity or process. Just as a circle has no end, the PDCA cycle should be repeated again and again for continuous HSE improvement.</td>
</tr>
<tr>
<td>PPE</td>
<td>51-52</td>
<td>Equipment to reduce employee exposure to hazards when engineering and administrative controls are not feasible or effective in reducing this exposure to acceptable levels. Employers are required to determine if PPE should be used to protect their workers.</td>
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<tr>
<td>Quality Assurance Principles</td>
<td>8</td>
<td>The planned or systematic actions necessary to provide adequate confidence that a product or service will satisfy given requirements for quality.</td>
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<td>Quantitative Risk Analysis</td>
<td></td>
<td>Normally understood as analysis of all elements relating to offsite risks. It is used for the remaining risk at a plant, including built-in safety measures. The result can be the basis for developing design requirements for certain parts of a plant and for preparing for emergencies and drills.</td>
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<tr>
<td>RCM</td>
<td>66</td>
<td>A systematic process used to determine what must be done to ensure that any physical asset continues to do whatever its users want it to do (stay reliable) in its present operating context.</td>
</tr>
<tr>
<td>Risk Based Management</td>
<td>32</td>
<td>Risk based safety management maintains that the residual risk from the empirical level (based on standards, engineering practice and experience) should be analyzed for the probabilities and the nature of hazard, and so give information for further risk control.</td>
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<tr>
<td>Root Cause Analysis</td>
<td>42</td>
<td>A method aimed at identifying the root cause of problems or events. The practice is predicated on the belief that problems are best solved by attempting to correct or eliminate root causes, as opposed to merely addressing the immediately obvious symptoms. By directing corrective measures at root causes, it is hoped that the likelihood of problem recurrence will be minimized.</td>
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<tr>
<td>RRR</td>
<td>34</td>
<td>A simple assessment technique to identify and evaluate hazards which could result in an undesired consequence, and propose actions. Risks are ranked according to predefined risk classes (normally low, medium, high).</td>
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<tr>
<td>SIL</td>
<td>61</td>
<td>A statistical representation of the reliability of the Safety Instrumented System (SIS) when a process demand occurs. It is used to measure the reliability of SIS. There are three categories: SILs 1, 2 and 3. In some cases also SIL 4. The higher the SIL is, the more reliable or effective the system is. SILs are correlated to the probability of failure of demand, which is equivalent to the unavailability of a system at the time of a process demand.</td>
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<tr>
<td>SJA</td>
<td>34,70</td>
<td>Job safety analysis carried out to outline consequences of unintended job-related incidents and suggest preventive measures.</td>
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<td>Safe Job Analysis</td>
<td></td>
<td></td>
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<td>SMART HSE Goals</td>
<td>38</td>
<td>Goals or objectives formulated to be:</td>
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<td></td>
<td></td>
<td>Specific, Measurable, Ambitious, Realistic and Time-limited.</td>
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<tr>
<td>Sustainable Development</td>
<td>81</td>
<td>Permits continuous improvements in the present quality of life at lower intensity of resource use. This leaves behind an undiminished or even enhanced stock of natural resources and other assets for future generations.</td>
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<tr>
<td>Synergi</td>
<td>53</td>
<td>Data software for registration and reporting of HSE incidents.</td>
</tr>
<tr>
<td>The Hydro Way</td>
<td>12</td>
<td>The Hydro Way is the promise we make that shapes our relationship with all of our stakeholders. It is based on our unique set of characteristics – who we are and what we believe in – and it defines our value-creating potential. The Hydro Way has three primary components: our mission, our institutional talents, and our values.</td>
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<tr>
<td>TPM</td>
<td>43</td>
<td>Total production maintenance or management, an improvement process technique</td>
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<td>TRI-rate</td>
<td>8,53</td>
<td>Also called the H2 value.</td>
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<tr>
<td></td>
<td></td>
<td>Total Recordable Injury rate is the sum of Lost Time Injuries, Restricted Work Cases (RWC) and Medical Treatment Cases (MTC) per million hours worked.</td>
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<tr>
<td>Verification and audits</td>
<td>89</td>
<td>As a part of the improvement process, the organization must from time to time go through an objective and independent examination</td>
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<td>WERA</td>
<td>41,55</td>
<td>Evaluates the exposure of normally occurring strains from the work environment for each individual employee. Examples are noise, chemical substances, radiation (including heat stress) and ergonomic factors linked to the development of musculoskeletal problems (including vibrations).</td>
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<tr>
<td>Work environment Risk Assessment</td>
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<tr>
<td>WERA-KPI</td>
<td>59</td>
<td>Work environment Risk Assessment - Performance Indicator</td>
</tr>
<tr>
<td>WOC</td>
<td>27</td>
<td>The preferred tool for communicating with employees regarding HSE practices in a work situation. It makes the manager more “visible” in his or her area of responsibility. It involves touring facilities to praise good HSE practice and correct bad practice.</td>
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<td>Walk, Observe, Communicate</td>
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<tr>
<td>1 on 1 dialogue</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Work permits</td>
<td>67</td>
<td>Necessary in order to secure a safe work place and avoid accidents when carrying out maintenance work or special service.</td>
</tr>
</tbody>
</table>
Hydro is a Fortune Global 500 supplier of aluminium and aluminium products. Based in Norway, the company employs 25,000 people in more than 30 countries and has activities on all continents. Rooted in a century of experience in renewable energy production, technology development and progressive partnerships, Hydro is committed to strengthening the viability of the customers and communities we serve.