SUSTAINABLE STAINLESS

ISSF INTERNATIONAL STAINLESS STEEL FORUM

Safety and Sustainability Awards 2018

Caring for our people and our planet

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Introduction from the Secretary-General

This is the 9th time that we have presented our Annual Awards for Sustainability and Safety and I am pleased to report that we have seen a slight improvement in entries for the Awards. It is still disappointing that there are some members who never send applications. All of our members are doing good work to improve their standards of safety and sustainability and they must all have stories that could be shared with other members. I hope that we will see a continuous improvement in entries for next year.

For this year we have received five entries for the Sustainability Award and a very encouraging 15 entries for the Safety Award. Even more pleasing is that the standard continues to improve, which makes the task of our judges very difficult. We had a panel of 9 judges who each scored every entry independently and their final scores were averaged to find the winners.

You all have your own programs to ensure the safety of your workforces and the protection of the environments in which you work. There is some excellent work being done in these areas. I would encourage you to tell us your stories. Our Annual Report on the Safety and Sustainability Awards should give us a solid message for the regulatory authorities and the general public about our focus on the safety of our people and the protection of our environment. It also enables us to publish these messages so that other members may learn from innovative practices. Our Awards Program is designed to reward excellence and commitment, but also as an incentive to all of our members to submit their own entries for these annual competitions.

This year's Award Winners have been selected in first, second and third placed categories. I congratulate them all for their worthy efforts.

There will inevitably be some disappointment among those who have not won an Award, but there are no losers here. Each of the submissions for this year's Awards has been a worth-while effort and they are all deserving of recognition. Accordingly, we have published all the submissions in the Annual Safety and Sustainability Awards Brochure, which I hope will enable the good ideas to be duplicated elsewhere.

John Rowe
Secretary-General
International Stainless Steel Forum
Shanghai
May 2018

JFE Steel Corporation

Award: Safety
Category: Safety Training

Raising the general safety awareness of employees

Challenge

JFE Steel routinely undertakes a variety of Safety and Health activities in line with its fundamental principle that, "Safety is the first priority". However, in spite of these ongoing efforts, industrial accidents have still occurred due to unsafe actions of workers caused by a lack of knowledge and awareness, or a failure to observe the rules. We need to ensure workers truly understand the fundamental importance of the safety first principle, and raise employees' and workers' safety awareness through corporate initiatives, including in the steelworks.

Action

In order to eradicate industrial accidents, it is important not only to enforce safety measures related to the use of equipment, but also to train people to be constantly aware of and compliant with safety rules, even if a person works alone without supervision. As one example of our efforts to raise safety awareness we created a Safety and Health poster, which is displayed where it is clearly visible in all workplaces. The concept of the poster is "Dialogue" to reflect the basic principle that "we value good relationships and communications" in the workplace. Using it is one concrete and cost-effective way we can constantly interact with our workers. The poster includes a photo of our company's president (Koji Kakigi) to emphasize that the focus on and commitment to safety comes from and applies to the top levels of management.

Outcome

Since the poster is displayed clearly and in many places throughout our offices and facilities, it acts as a constant reminder to all employees to make safety their top priority and to keep it in mind at all times – especially for our new employees and for our contractors. As a result, we have seen evidence of a wider understanding of the fundamental importance of the safety first principle, and higher general levels of safety awareness among our employees.

JFE Steel's Safety and Health Poster in 2018 whose concept is "Dialogue"

Outokumpu Oyj

Award: Safety
Category: Workplace Improvement; Safety Training

SafeStart safety initiative

Challenge

Outokumpu had been looking for a safety behavioural program which addressed safety on a 24 / 7 basis, not just at work, but a program which employees could make use of in their home and family lives and when commuting. Full participation and engagement from the whole workforce and resident contractors were also viewed as key to changing the safety culture of the company.

Although the accident severity and the lost time injury frequency rate has been decreasing year on year "safety "proves to always be a topic which constantly needs to be reviewed and the introduction of a new safety program was felt could help us achieve our safety mission of zero accidents. The behavioural safety awareness program "SafeStart" aims at reducing accidents by helping us recognize the error states that occur and the critical errors that cause them.

In a manufacturing company like Outokumpu, we often associate safety first and foremost with the production environment. It's true that there are hazards in stainless steel production that must be recognized and mitigated, but it's also a known fact that the majority of accidents happen to the individual outside work, for example at home or when moving from one place to another e.g. driving. If you are hurt badly, in the end it doesn't really matter where it happened, we need to eradicate all accidents.

Action

SafeStart is a behavioural safety awareness program delivered to groups initially in 5 two-hour training sessions and is aimed at reducing accidents by helping the individual and his work colleagues effectively recognize the behaviours i.e. errors and mistakes that cause them. The SafeStart program will eventually be implemented in all locations, both at our production sites as well as in our offices, to our employees and resident contractors.

SafeStart can perhaps be best described by explaining what it is not. First, it is not about rules or telling people what to do. It is also not meant to replace sound engineering or good safety management practices such as safety observations or risk assessments, nor replace training people on specific workplace hazards. It is all about keeping those hazards in mind and in sight – at work, at home and on the road. SafeStart's aim is to target unintentional hazardous behaviour and turn bad habits into good habits.

SafeStart gives us a common language for accident reduction techniques and analysis and changes safety from outside / in, i.e. rules, procedures which are given to employees, to inside / out, empowering the individual to self-trigger in his actions.

Outokumpu Oyj

Award: Safety
Category: Workplace Improvement; Safety Training

SafeStart safety initiative

In SafeStart language, there are four states:

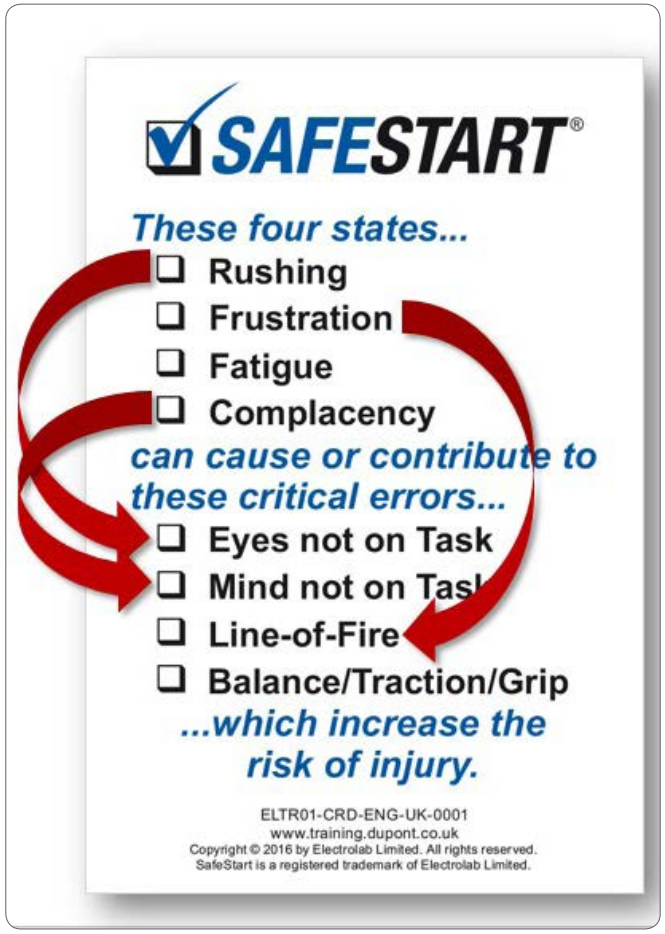
- **Rushing**
- **Frustration**
- **Fatigue**
- **Complacency**

that can lead to four injury causing errors:

- **Eyes not on task**
- **Mind not on task**
- **Line of fire**
- **Balance/Traction/Grip**

Teaching us how to recognize these risky patterns and how to utilize clearly defined techniques to reduce them is one of the key components in SafeStart learning. SafeStart utilises a repetition method to drive the understanding and use of the states and errors and encourages individuals to tell their stories of when they were injured or had near misses at work, at home or when driving.

Safestart is unique as it is delivered by your own employees who have participated in train the trainer sessions with safety consultants. This approach enables the trainers to interact with the trainees as they are regarded as one of the workforce and trainee participation is a key element when discussing near misses and close calls as a"Safestart story".



After the five modules are complete Safestart needs to be sustained, therefore by the addition of posters around site featuring key personnel and safestart trainers with personal statements is one of many methods we have used to keep the initiative fresh in employee's minds.

Cards with safety related habits are issued, so employees can decide which habits caused the potential accident and work on that habit and record these. The content is shared with other colleagues to spread the knowledge and learning.

Safety behavioural observations are enhanced by using the four states when having a discussion with employees, by asking people to rate their state at a given time gives you a topic to discuss and agree workable solutions to maintain everyone's safety.

Outokumpu Oyj

Award: Safety
Category: Workplace Improvement; Safety Training

SafeStart safety initiative

Outcome

SafeStart has helped employees target small errors and risky behavioural patterns by raising our awareness and providing us with error-reducing techniques to avoid them.

Total recordable injury frequency rate and accident severity has fallen in 2017 by more than 50% across the business and we believe safestart has played a significant role.

Sites in Sheffield (UK) and Calvert & Richburg in America have completed all 5 modules and are now utilising the benefits in daily management meetings as well as accident / near miss reporting and safety observation auditing.

One major safety related habit which has stuck within Outokumpu is holding the handrail when ascending and descending a staircase, this is a simple task but the consequences of failing can be major.

Safestart cards are helping with our data collection and are analysed to spot trends in states and errors.

Feedback from the training has been very positive with employees stating that the training and delivery was excellent, it has enhanced their safety awareness at work, home and on the roadand has made them concentrate and work on good safety habits.

North American Stainless

Award: Safety
Category: Workplace Improvement

Workplace Safety Improvement

Challenge

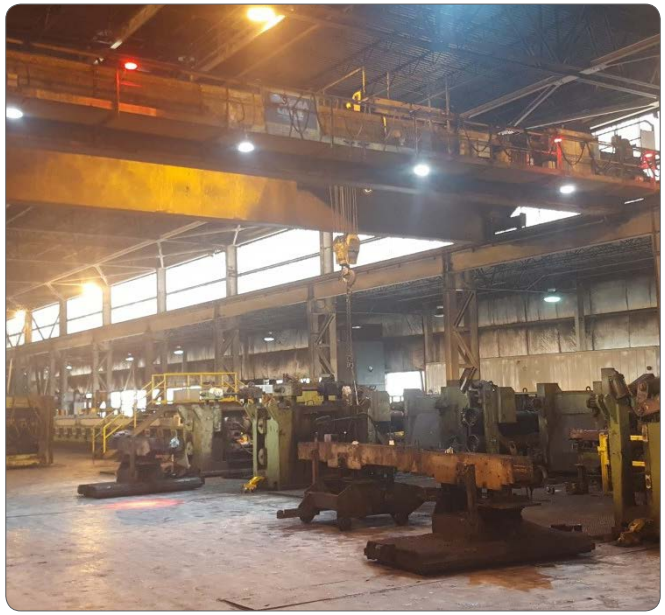
Bring awareness to overhead crane movement.

Action

North American Stainless has several overhead cranes throughout our facility. All of our cranes are equipped with sirens and our operators are trained to sound the siren when they move their crane. The problem was with so many noises in a manufacturing area, employees would get complacent with the siren noise. We had a near miss in our Melt Shop a couple of years ago with a crane so this caused us to look into a better way to identify crane movements. We made the decision to add bright red lights on all of our cranes. These red lights point down towards the floor so that anybody in the area can see where the crane is at. We added the red light crane identification to our Contractor training also so that they are aware to look for the red light on the floor when out in the facility.

Outcome

Adding the red light has greatly reduced near misses in our Melt Shop and other areas throughout the facility. We've had visitors in and they have said that they would like to take our idea and implement it in their facilities.



North American Stainless

Award: Safety
Category: Workplace Improvement

Workplace Safety Improvement

Challenge

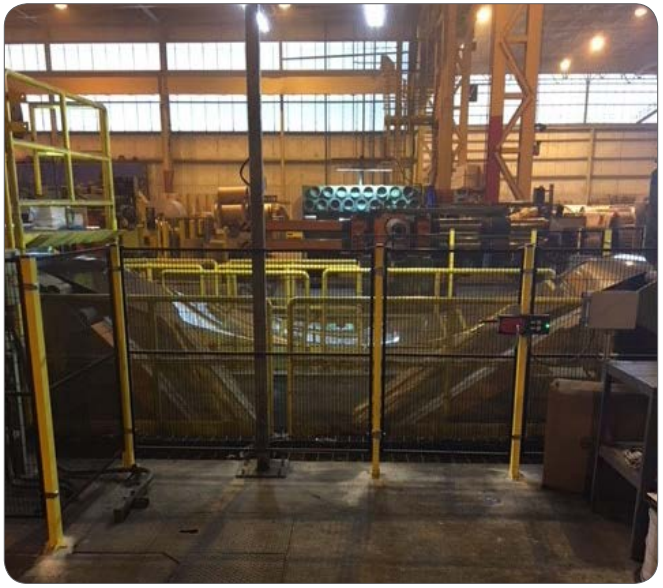
North American Stainless (NAS) has a lot of older equipment and a challenge for us has been able to find ways to get older equipment guarded with 2018 guarding. Two of our Slitters were installed back in the 1990's but we need to comply with 2018 guarding standards.

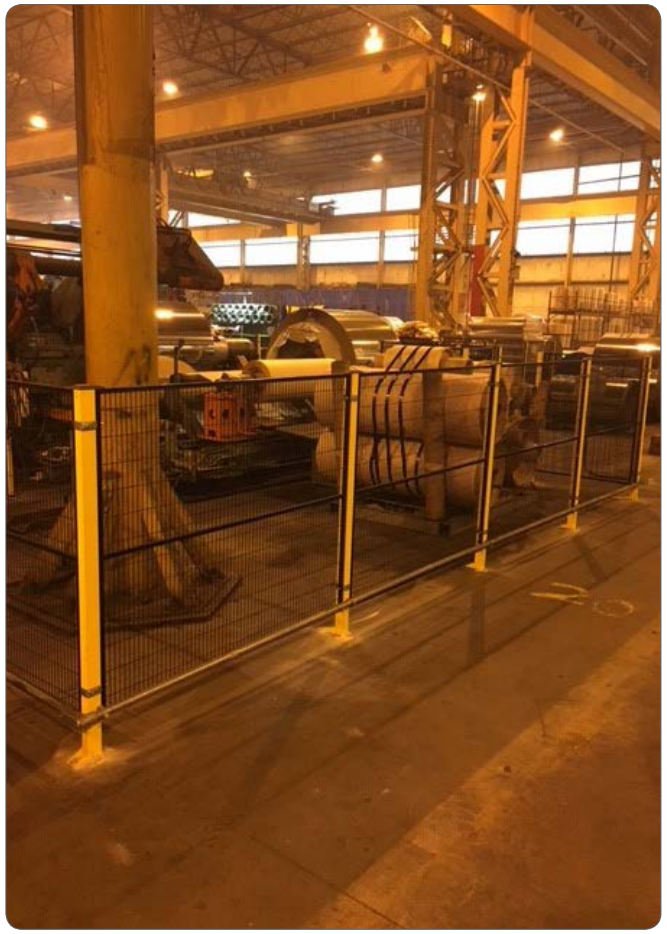
Action

Guarding – when we started up our new slitter line in 2017 we took that blueprint and our Electrical Maintenance department found a way to wire our old slitter lines with new interlocks and we placed several hard guards onto the line. With older technology on the line it was difficult to get everything to work but we were eventually able to use a combination of hard guarding, SIC lights, and interlock gates to protect employees from entering the line.

Outcome

At first some employees that have been here for a while didn't feel they would be able to run production with the new guarding. Now employees are used to the new guarding and even point out areas where we can make improvements.





North American Stainless

Award: Safety
Category: Workplace Improvement

Workplace Safety Improvement

Challenge

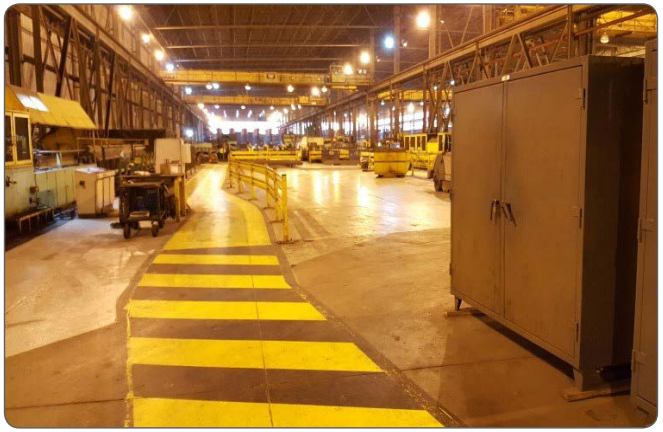
We were faced with the issue of too much fork lift and pedestrian traffic throughout the mill and not enough designated walk ways.

Action

Every Mill Manager was tasked to find a way to separate as much fork lift traffic from pedestrian traffic as possible. In addition, they needed to find areas where we could paint designated walkways. The other challenge was finding a way to ensure all pedestrians knew whether or not there was a need to look out for crane or fork lift movements. Safety came up with designated paint colours for walk ways that would inform pedestrians if the area was safe or caution was needed when walking in the area.

Outcome

We have found pedestrians have a better understanding of where it is safe to walk and they understand where to watch out for potential hazardous. The signs and designated walk ways also work very well for visitors.



ACERINOX EUROPE S.A.U.

Award: Safety
Category: Workplace Improvement

Legionella and cooling towers; Control 4.0.

Challenge

To avoid a dangerous occupational disease such us Legionellosis in a high risk installations like cooling towers systems at the mill.

Action

Total control and management of the main operative parameters of the water cooling system for cooling towers, in real time. Legionellosis is a collection of infections caused by Legionella Pneumophila and related Legionella bacteria. The severity of Legionellosis varies from mild febrile illness (Pontiac fever) to a potentially fatal form of pneumonia (Legionnaires´ disease) that can affect anyone, but principally affects those who are susceptible due to age, illness, inmunosupression or other risk factors, such as smoking. Infection is acquired through breathing in aerosols (very fine droplets of water) which contain the bacteria. Aerosols are produced in cooling towers and the bacteria could be in all system: machinery, tanks, valves, pipes, trays, etc.

Main parameters we must to control and manage are: temperature, pH, concentration of biocide, turbidity and conductivity. Temperatures between 25-50 ºC are optimal for Legionella growth (temperature of water in these systems is kept between 28 ºC and 45 ºC. High ph favours legionella proliferation (recommended 7.5 -8.0). Biocide content like Hypochlorous Acid must be kept between 150 -250 ppm (Cl content), conductivity 2000 µS/cm (recommended), in a future we will control turbidity <15 UNF for this new system. Equipment and programs (software) has been developed to do that.

Cooling tower

Methodology of control:

1. Supervision: 24 hours / 365 days/year, which will ensure an exhaustive control, while minimizing the time necessary to detect and to correct any possible deviation of the main parameters. Provide graphical reports in which it could be appreciated immediately the operation indicators and provide alarms and tips in order to correct the deviations if occurred.
2. Action: the equipment makes checks and measurements needed to maintain an optimal quality of the water in the cooling tower

Parameters control system

ACERINOX EUROPE S.A.U.

Award: Safety
Category: Workplace Improvement

Legionella and cooling towers; Control 4.0.

system.

3. Risk prevention: when the equipment detects a deviation, send immediately an alarm by wi-fi, alerting to our technicians by e-mail and SMS messages. Then our technicians will proceed to evaluate and to act, before the cooling tower system will be in a not acceptable status (parameters out of range). With the communication software, technicians can act in remote, even from a laptop, table, smartphone, etc. For instance:
    - Changing the aiming and modifying the doses.
    - Adding additives.
    - Purging the systems.
    - Stopping the installation if necessary.

Outcome

First and foremost, ACERINOX EUROPA S.A.U. wants to ensure the health of all workers, visitors even neighbourhood near factory in order to avoid the appearance of the bacteria, taking information in real time of the main parameters that permit to take the proper decisions.

Detail of control panel

Don´t forget that if the Legionella appears, even causing an outbreak of disease, not only consequence for the workers, visitors and neighbourhood affected, but for the installation, as follows: it´s necessary to stop installations for disinfestation (meaning stop the production); bad image of the company, etc.

In addition:

- This project tries to protect the cooling tower installation systems, maximizing the lifetime and reducing the maintenance. This decreases the workload of the maintenance workers and the risks of accidents too.
- Increase saving, minimizing the use of resources, water energy and additives
- Integrate the Occupational Risk Prevention with the Industry 4.0 model, introducing what has been called the “smart factory,” in which cyber-physical systems monitor the physical processes of the factory and make decentralized decisions. The physical systems become Internet of Things, communicating and cooperating both with each other and with humans in real time via the wireless

ACERINOX EUROPE S.A.U.

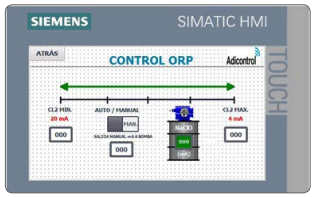
Award: Safety
Category: Workplace Improvement

Legionella and cooling towers; Control 4.0.

web. There is an interoperability — machines, devices, sensors and people that connect and communicate with one another.

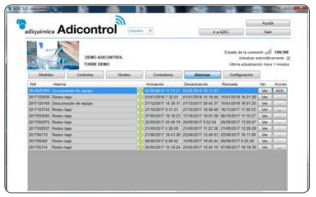
- In the future this project will be installed in another high risks installations for Legionella, like domestic hot water for changing rooms and shower areas for the workers and evaporative coolers used in workshops and bays.
- An APP for IOS and Android is been developed, in order to control easily from smartphone, and access the system from anywhere.

Main screen

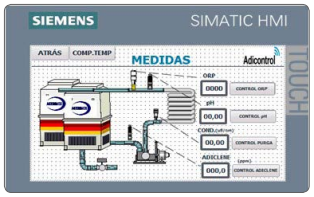


Screen with chlorine control

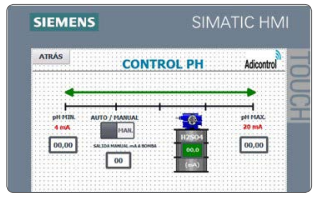
Screen for pH control



Screen for alarms, link status etc.

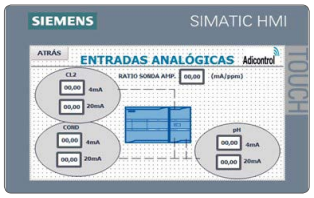


Screen with measures of different parameters

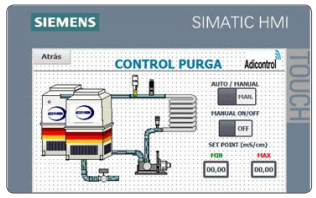


Screen with pH control

Screen for Chlorine control



Screen with analog inputs



Screen with purge control

Screen for pump of biocide control

Nippon Yakin Kogyo

Award: Safety
Category: Workplace Improvement

Reducing toxicity of thermal insulation material by replacing it with lower hazardous material

Challenge

Industrial Safety and Health Law has newly identified Refractory Ceramic Fiber (hereinafter, RCF) as a Specific Chemical Substance that may be carcinogenic. We conventionally used higher toxic RCF as a thermal insulation material for mainly furnaces at 14 sites in our plant. In addition, being itself toxic, however, we have several kinds of problems with regard to storing, to disposing of it as well as to checking the workplace environments according to Industrial Safety and Health Law.

Action

We tried to apply the Bio-soluble fiber that contains lower hazardous material and has same performance as we used conventionally at our all 14 sites. The test results allowed us to use it at every site, consequently we have replaced higher toxic RCF with lower hazardous material, that is the Bio-soluble fiber. Furthermore, the Bio-soluble fiber is out of the scope of Specific Chemical Substances.

Outcome

Since the new thermal insulation material is the Bio-soluble fiber, the possibility of carcinogenesis has declined even if we breath it in. In addition, we have reduced the legal procedures with regard to the thermal insulation material.

Nippon Yakin Kogyo

Award: Safety
Category: Safety Training

Safety training for third-year employees

Challenge

At our Kawasaki plant, we are promoting the prevention of industrial accidents and health disorders with the aim putting safety first. The objective of our comprehensive safety activities is to achieve a safe work place without any risks as well as to promote both physical and mental health. We have been systematically executing the safety training about not only the legal compliance requirements but also our own regulations. However, the accident occurrence tendency indicated to us that many of our industrial we have experienced accidents were caused by the inexperienced employee with under five years of experience.

Action

We started a new safety training, shown below, for third-year employees.

1. Why industrial accidents happen? Background of accident occurrence and readiness for accidents.
2. Hazard prediction training and hazard avoidance behaviour.
3. How to do risk assessments (Identify and evaluate risks)
4. Group discussions and case studies about the actual accidents we experienced in the past.

Outcome

We have reduced the number of industrial accidents.

Before the new training; 7.8 accidents/ annum (based on 2003-2006)

After the new training;4.9 accidents/ annum (based on 2007-2010)

Nippon Yakin Kogyo

Award: Safety
Category: Workplace improvement

Preventing electric shock by covering the power fuse charging unit of high voltage facilities (AC3000V)

Challenge

When we inspected the circuit breakers at the high voltage facilities (AC3000V), there were risks of electric shock, since the circuit breakers to be inspected were located near the power fuse charging units.

Action

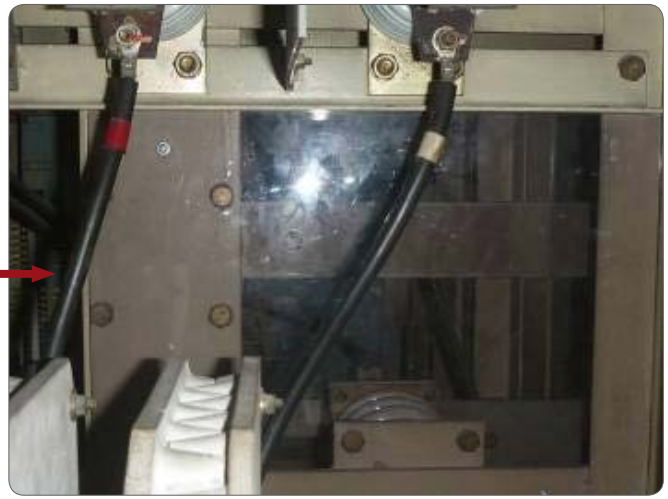
We covered the power fuse charging units to prevent electric shock by using a plastic insulating guard made of insulation. Furthermore, since this guard is made of transparent insulation it is also easy to inspect the power fuse charging units.

Outcome

We have reduced the risks of the electric shock.

The power fuse

Installing the insulation to the bus bars

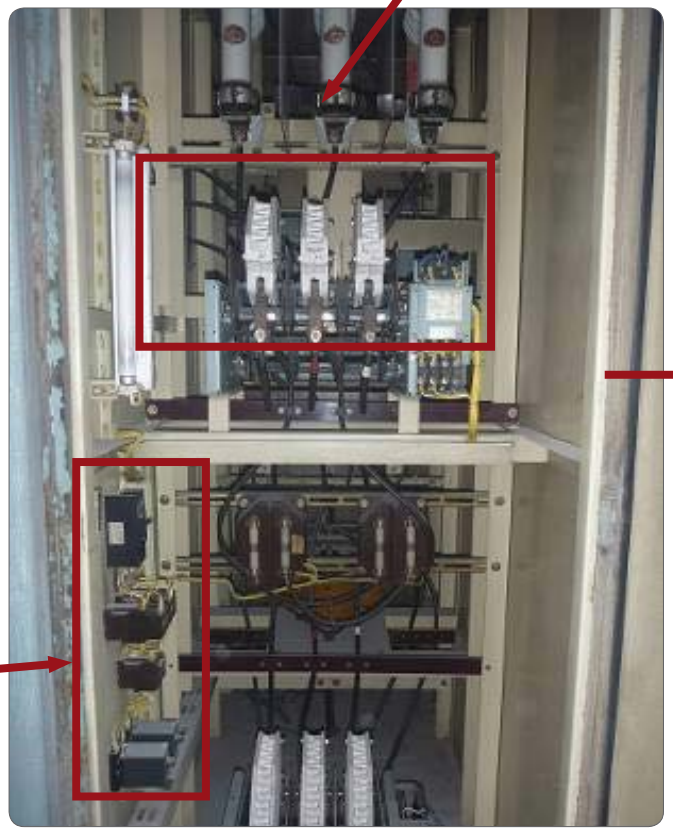


Nippon Yakin Kogyo

Award: Safety
Category: Workplace improvement

Preventing electric shock by covering the power fuse charging unit of high voltage facilities (AC3000V)

The naked terminals



Installing the insulation to the bus bars

The circuit breakers to be inspected

Nippon Yakin Kogyo

Award: Safety
Category: Accident analysis

Lessons learned from a fire that happened at the dust collector

Challenge

At our Kawasaki plant, we are promoting the prevention of industrial accidents and health disorders with the aim putting safety first. The objective of our comprehensive safety activities is to achieve a safe work place without any risks as well as to promote both physical and mental health. However, we had an involuntary fire accident which occurred at a dust collector. During our periodic maintenance, we used an electric drill to repair a crack which happened at the hanging beam of the dust removal device. While the repairman was using an electric drill, he noticed a lot of smoke from the filter cloth below the hanging beam and made an emergency call. This fire caused us to revise our safety training plan as well as our own regulations with regard to treating high temperature substances including electric tools such as the electric drill.

Action

We revised our own regulations and training plan with regard to preventing a fire and all relevant employees also had an emergency training. The facilities director gave a strict warning to the employees who caused this fire accident (including our contractors). Accordingly, all employees of the facility division had an emergency training. Furthermore, all employees including other divisions received a lecture about this fire incident. Making our own regulations stricter required specifying prevention methods of fire for each construction or repair and the drill which has being newly defined as a substance which could cause fire. Basically, using fire itself and the tools could cause fire was strictly prohibited inside the dust collector. In this revision, when using them inside dust collector unavoidably, removing all inflammables (including filter cloths and metal dust) and using flame retardant fabric are necessary. Hereafter the fire prevention training will be conducted three times a year.

Outcome

The thorough training improved our awareness of fire risks. Making our own regulations stricter has reducing the possibility of fire.

Nippon Steel & Sumikin Stainless Steel Corporation

Award: Safety
Category: Workplace improvement

Prevention of injury accidents in machine operating area of gate type hoist

Challenge

It is fundamental to prohibit entering into machine operating areas for ensuring the safety of workforce. In fact, however, some accidents have occurred by not complying with basic rules.

In 2016, a lost time injury accident happened at a gate-type hoist of the construction material storage site in Hikari Works. Therefore, a structural measure was implemented, in addition to non-structural measures such as use of operation prohibition tags at the time of entering, risk prediction activities, and alerting operators for attention.

Action

The hoist is used by multiple construction companies to process and store materials. The injury accident in 2016 occurred during a worker was operating the hoist. Another worker of different company walked in the rail to find some material. At that time, his toe was pinched by the moving wheel of the hoist (Fig1).

We have made instructions to outsource-companies in the works to take non-structural measures to prevent operators from entering any machine operating areas. However, it was not efficient to be implemented in workplaces where operators from multiple companies were working, because it was difficult for each worker to be noticed actual operating situation of other companies. Therefore, we have considered how to make it fundamentally safe by improving the facility itself.

We installed safety fences around the rails of the hoist to restrict operators to walk in. Moreover, the entrances of the fences are locked so that only workers from hoist management company can enter.

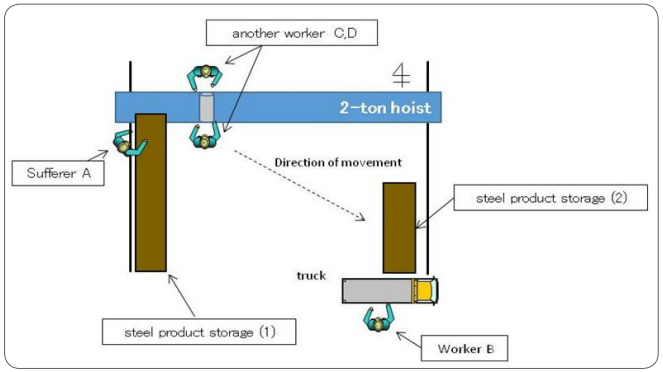


Figure 1: Positional relationship at the time of disaster

Nippon Steel & Sumikin Stainless Steel Corporation

Award: Safety
Category: Workplace improvement

Prevention of injury accidents in machine operating area of gate type hoist

Outcome

As a result, the possibility of such accident would be much lower than before the countermeasure. Even if risk prediction activities are not enough, injury accident would be no longer occurred.

Based on the experience from this injury accident, we started to implement measures for all similar hoists and cranes. There are 17 similar units in NSSC and we have already done measures for 10 units. Measures for remained 7 units will be completed in 2018.

We are continuously working to implement countermeasures to ensure the safety of not only our employees but also contractors.

Before

After

POSCO

Award: Safety
Category: Workplace improvement

"Fatal Top 10" campaign for serious accident prevention

Challenge

We are endeavouring to prevent safety accidents. However, safety accidents are continuing without decreasing, and social costs and responsibilities are also increasing day by day. We had not been able to eliminate the root cause of safety accidents. So a fundamental and systematic approach is desperately needed to prevent safety accidents.

Action

We selected 10 key risk factors that could lead to fatal accidents and industrial accidents. And we conducted intensive improvement activities and management with risk assessment. For each plant(6 plants including 23 units process), the risk level was divided into 5 levels of severity level and 5 levels of operation frequency, and then high level ranked 10 factors(total 60 items) were selected according to the risk level. Through the selection and concentration of major accident-causing factors, the systematic improvement was made in advance. This "Fatal top 10" activity restarts annually through newly searching for other 10 key risk factors of each plant. In addition, Mentoring of department heads was carried out every month, thereby enhancing effectiveness of preventive activities and increasing the participation of employees.

Outcome

Since 2015, accidents have not occurred and accident-free work place have maintained.

Columbus Stainless

Award: Safety
Category: Workplace improvement

Security personnel being injured while scanning outgoing steel at the weigh bridge

Challenge

At present, security guards that have to scan the outgoing material, are using aluminium A-Frame ladders, to climb onto the truck and trailers. Due to a curb, at the weighbridge area, the ladder cannot be fully opened. The security guards are slanting the ladder against the truck with no support.

Concerns are as follows:

- Damaged ladders due to not being removed before the truck drives away.
- Ladders are frequently replaced, carrying an excessive cost to the company.
- Guards not able to professionally handle the paperwork.
- Potential injury to the Security guards that can fall from the ladder.
- According to regulation step ladder must be in the open position, before accessing the ladder – this did not happen.
- No second person was helping to secure the ladder as per regulation.
- Once the guard has reached to top of the ladder he has to swing his leg over, and step sideways onto the truck/trailer.
- Climbing and scanning operation time approximately 10 minutes per truck.
- While carrying scanning equipment and paper work, no three contact points with ladder as per regulation. (two feet and one hand or two hands and one foot)
- No stop/go indication to the truck driver.

Before: ladder has to be carried from truck to trailer. There is a possibility the person moving the ladder may fall off the curb and cause injuries.

Before: UNSAFE ACT: Guard has to use only one hand to climb the ladder. Stepping off the ladder, on to the truck, the guard must lift his or her leg over the ladder, which is unsafe.

Columbus Stainless

Award: Safety
Category: Workplace improvement

Security personnel being injured while scanning outgoing steel at the weigh bridge

Action

We purchased a movable ladder, and modified it, to such an extent that the guards are not able to fall off if the ladder slides.

To enable the ladder to be directly parallel to the truck, the frame has been bolted down to the concrete, the smaller frame with steel wheels has been bolted to the ladder which enables it to move right up against the truck and trailer.

We have installed a limit to the frame so when the ladder is against the truck a red light will shine instructing the Truck Driver, not to move.

Once the material has been scanned and the guard is safely on the ground, the guard will then move the ladder backwards, which will make the limit and a green light will light up to instruct the driver he can proceed.

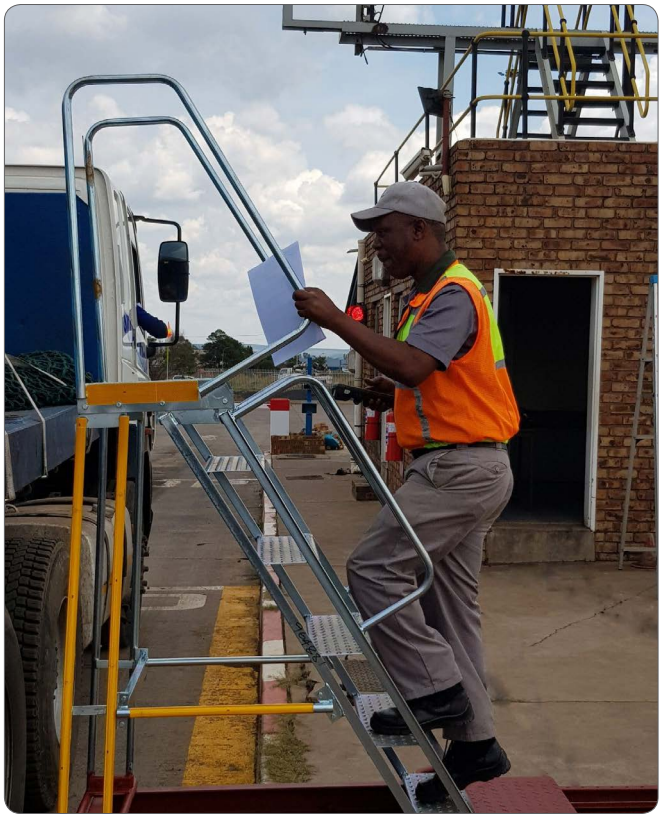
Frame with ladder mounted

Ladder in home position, green light will be visible (cables re-routed to minimise tripping hazard)

Columbus Stainless

Award: Safety
Category: Workplace improvement

Security personnel being injured while scanning outgoing steel at the weigh bridge



Guard climbing onto modified ladder, to climb onto truck/ trailer, free movement of hands

Stepping off the ladder onto the truck is a much safer way than climbing off the ladder on to the truck

Climbing off the truck or trailer can be done forwards, not like with the A-frame, it had to be done backwards and the chance of falling off was always a problem

Columbus Stainless

Award: Safety
Category: Workplace improvement

Security personnel being injured while scanning outgoing steel at the weigh bridge

Outcome

Benefits are as follows:

- Less disposal of wrecked step ladders.
- Cost saving to the company.
- Less injuries.
- Security guards are able to move more freely with their paperwork and scanners thus being more productive.
- Operation time has been reduced to approximately 3 minutes per truck.
- Guards walking distance is reduced to approximately 10 meters per operation. (800 meters per 24 hour shift)
- Guards do not have to carry ladders.
- Robot indication to truck driver (green-go red-stop, by a limit switch)
- No more lifting of ladders which eliminates back injuries.

SIJ - Slovenian Steel Group d.d.

Award: Safety
Category: Accident analysis, Safety training, Skill training

"Working safely, staying healthy" - employee awareness health and safety

Challenge

1. DEFINING THE PROBLEM OR

OPPORTUNITY

A. CIRCUMSTANCES/WIDER IMAGE OF THE PROJECT

In the SIJ Group we produce steel and steel final products with a total 3,100 employees – 70% of employees work in a demanding working environment.

While the SIJ Group is noticing a gradual decrease in the number of accidents and sick leaves in recent years, we registered over 160 accidents in the Metallurgical Division in 2015.

B. AN OPPORTUNITY FOR COMMUNICATION SUPPORT

We started a communication campaign aimed at raising employee awareness on health and safety "Working safely, staying healthy" at key metallurgical companies with 2,550 employees in 2016 and continue it in 2017.

The communication goals of the campaign are in line with the business goals.

Long-term goals of the SIJ Group

Ensuring health and safety and reducing the consumption of financial means of the SIJ Group for covering sick leave expenses and settlement claims for work accidents, to achieve:

a) 0 work place accidents ⟶ we will reach them gradually year after year

b) a 6% sick leave on the overall level of the Metallurgical Division of the SIJ Group.

Communication goals of the campaign

a) Raising employee awareness on the importance of health and safety: directly or indirectly include at least 75% (2,550) employees from companies cooperated in the campaign.

b) Provide communication support for systematic measures aimed at improving health and safety in 2016 and 2017, thereby raising employee awareness on the necessity of performing these activities.

c) Raising the awareness of leaders, who can have a vital contribution to the reduction of sick leaves and the lowering of the number of workplace accidents.

d) Raising awareness for the most common causes of workplace accidents and how to avoid them.

The 2016 campaign concluded on 22 March 2017 and 16 March 2018.

C. CHALLENGE: preparing a uniform communication campaign that will be suitable for all companies, the various natures of their production facilities, various systemic measures/activities, etc.

2. RESEARCH

A. Examining and analysing companies' statistical reports on workplace accidents

B. Examining and analysing the indicators of sick leave.

C. Examining and preparing a set of individual

SIJ - Slovenian Steel Group d.d.

Award: Safety
Category: Accident analysis, Safety training, Skill training

"Working safely, staying healthy" - employee awareness health and safety

systematic measures and activities for individual companies which would be accelerated via the communication campaign:

a) **A Minute for Safety**: a formally prescribed 5-step procedure carried out by each production shift before going to work to ensure workplace safety. It is headed by the shift foreman.
Pre-campaign status: not all shifts are performing it regularly and correctly.

b) **Innovative suggestions**: each employee may at any time give an innovative suggestion for implementing improvements in the production processes, work processes, new ideas, etc.
Pre-campaign status: few suggestions given for the improvement of occupational health and safety

c) **Systematic monitoring of workplace accidents**: monitoring the indicators for individual companies.
Pre-campaign status: reports were available to all heads of production shops, the director of production, and CEO; shift foremen and employees do not know the statistics (even for their own shop).

d) **Instructions for safe work**: a formal internal rule book defining how to work correctly, e.g. working at height, with lifting devices (cranes), hand tools, etc.
Pre-campaign status: prepared as an official document that is not appropriate in shape and form for the employees.

e) **Employee education** on legally prescribed occupational health and safety.
Status: in progress.

f) Adhering to **legal regulations** on health and safety.
Status: in progress.

D. Talking to safety engineers at individual companies on the problems and opportunities in health and safety.

Action

4. Implementing Communication Activities

A) THE HEALTHIEST PRODUCTION SHOP WITH NO WORKPLACE ACCIDENTS

In 19 production shops/programmes in 2016 and in 24 in 2017 employing just under 2,700 people, we monitored the number and type of workplace accidents and sick leaves on a monthly and quarterly basis. Each month and quarter when a shop achieves 0 workplace accidents and/or their target percentage of sick leave, it is awarded points. We published monthly charts of the best shops, and awarded the best ones each quarter with branded promo material.

To bring the statistical data closer to the employees, we visualised the goals in so-called silhouettes that we placed in the production facilities. We used them to publish the goals for individual shops, a monthly chart, and with each workplace injury, we marked where it occurred on the body on the "human silhouette", adding to that what had happened and a piece of advice on how to avoid the trauma in the future.

At the end of the year, we declared the winner (one on each location):

- the winning shop in Ravne na Koroškem registered 0 workplace accident during the year, compared to 6 in the year before

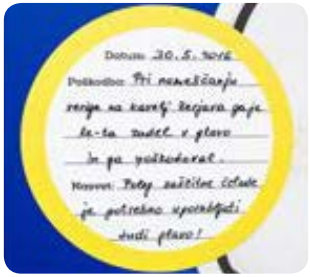
SIJ - Slovenian Steel Group d.d.

Award: Safety
Category: Accident analysis, Safety training, Skill training

"Working safely, staying healthy" - employee awareness health and safety

- the winning shop in Jesenice registered 1 workplace accident and did not do worse compared to the previous year

Each shop received a financial award in the sum of the means gathered, which the employees spent how they chose (for a trip and sporting events), while the employees chose where the same amount is to be donated to the local community.



Silhouettes in the production shops

Rewarding ceremonies for the winning production shop

B. WORKSHOPS ON THE IMPORTANCE OF HEALTH AND WORKING SAFELY

We organised 25 workshops in 2016 and 23 in 2017 for the employees, shop managers, management of key companies. The workshops were used to discuss the meaning of health and wellbeing of the employees through real examples from the companies, and stories from the managers and employees.

C. POSTERS AND BILLBOARDS

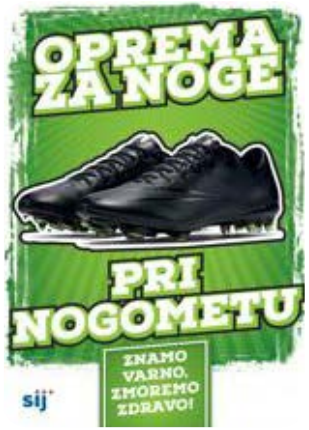
We had posters in the working facilities:

- in 2016: reminding employees to diligently use protective gear and follow rules for safe work. On the posters, we transferred the mindset from home and free time (where it goes without saying that we, for example, wear a helmet when riding a motorbike) to work (where employees sometimes disregard rules on using safety equipment at work).

SIJ - Slovenian Steel Group d.d.

Award: Safety
Category: Accident analysis, Safety training, Skill training

"Working safely, staying healthy" - employee awareness health and safety



2016 posters: transferring the mindset from home and leisure time

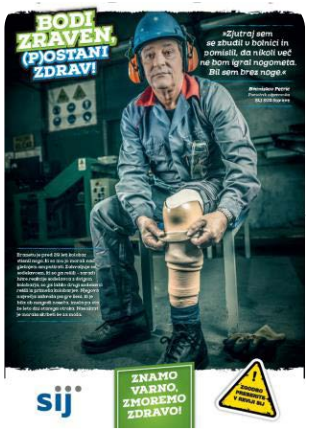
- in 2017: true stories of employees we will present co-workers who were injured in the workplace as ambassadors – the name of the spark was The Shocking Campaign

The posters were launched 4 times during the year in several waves.

In April 2016 and in 2017, the month dedicated to professional health and safety, we also placed billboards in Jesenice and Ravne na Koroškem, which were:

a) connected through content with the internal campaign

b) still general enough so that the local community unfamiliar with the campaign recognised the billboard as a general



2017 posters: true stories of employees who were injured

SIJ - Slovenian Steel Group d.d.

Award: Safety
Category: Accident analysis, Safety training, Skill training

"Working safely, staying healthy" - employee awareness health and safety

A. A MINUTE FOR SAFETY with AMBASSADORS + POCKET HANDBOOK FOR IMPLEMENTATION

A Minute for Safety is a formally prescribed procedure carried out by each production shift before going to work to ensure safety in the workplace aimed at preventing workplace accidents. It contains five prescribed steps.

In April 2016 and 2017, the month dedicated to professional health and safety we performed with the ambassadors performed no less than 58 Minutes for Safety (in 2016) and 61 in 2017 all production shops.

The regulations for conducting the Minute for Safety were introduced to the heads and employees through a pocketbook guide, which fits in the pockets of the employees' work clothes, so they can always carry it with them.

SIJ - Slovenian Steel Group d.d.

Award: Safety
Category: Accident analysis, Safety training, Skill training

"Working safely, staying healthy" - employee awareness health and safety

E. OCCUPATIONAL HEALTH AND SAFETY HANDBOOK

To introduce the formal internal rules defining how to properly work at heights, with lifting devices (cranes), hand tools, etc. to existing and especially new employees immediately upon employment, we customised the contents of the rulebook, published it in a convenient format and titled it ADVICE FOR OCCUPATIONAL HEALTH AND SAFETY.

In 2016, it was handed out to all heads, and new employees received it at all of the companies.

F. TENDER: SPARKS FOR IMPROVING WORKPLACE HEALTH AND SAFETY

In April, the month dedicated to occupational health and safety, we published an internal tender where we invited employees to give their suggestions.

The subject: How would you encourage your co-workers to take better care of their workplace health and/or safety?

Together we received 122 ideas in 2016 and 44 in 2017 from the employees of the 5 companies' production shops and joint services. We selected 1 from each company, which has been implemented:

- as part of the internal TV network of the SIJ Group, we launched a counter of accident-free days (see image below); every time a person is injured at a individual company, the counter is reset to 0.

Advice for occupational health and safety

Accident free days counter

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Award: Safety
Category: Accident analysis, Safety training, Skill training

"Working safely, staying healthy" - employee awareness health and safety

- for the 2017 campaign, we presented co-workers who were injured in the workplace as ambassadors – the name of the spark was The Shocking Campaign; they warn their colleagues to follow the rules of occupational health and safety through photographs of their serious injuries (an amputated leg, head trauma, burns, etc. – real cases listed below) and personal stories
- we placed more healthy snacks (e.g. nuts) instead of candy in a company's vending machine, etc.

G. THE CONTENTS OF INTERNAL COMMUNICATION TOOLS

Throughout the year, we used and combined the SIJ Group's internal communication tools to communicate regarding all activities

- as the main topic of the SIJ corporate magazine, received by 3,400 employees
- as the main thread or a subject of individual sections of the companies' monthly newsletters

A. on bulletin boards (instructions for individual activities, announcements of winners, etc.).

One of the articles in the SIJ employee magazine

H. AOD (DEFIBRILLATORS) AND EMPLOYEE TRAINING ON STEP BY STEP USE OF AN AED

We placed defibrillators in all locations where SIJ Group companies operate that are also available to local communities and invite employees on training how to use use it.

Employee training at Ravne na Koroškem

Outcome

Long-term goals of the SIJ Group

a) 0 work place accidents

b) a 6% sick leave on the level of the Metallurgical Division of the SIJ Group

Results achieved:
in 2016:

Through the years, we will gradually come close to our long-term goal of 0 workplace accidents,

SIJ - Slovenian Steel Group d.d.

Award: Safety
Category: Accident analysis, Safety training, Skill training

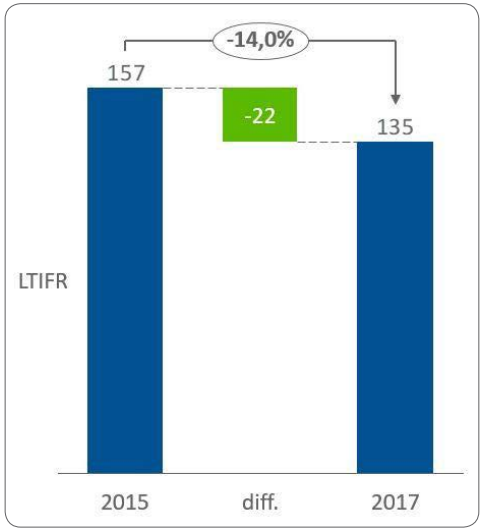
"Working safely, staying healthy" - employee awareness health and safety

but we are still noticing important short-term milestones, which prove the campaign's effectiveness:

- the second largest metallurgical company, SIJ Metal Ravne, registered the first year that all shops went at least one month accident-free in 20 years
- the winners of the campaign in Ravne na Koroškem registered 0 workplace injuries, compared to 6 the year before
- all 12 shops that we monitored in Jesenice registered at least one accident-free month
- 6 out of 7 production shops in Ravne na Koroškem registered at least one accident-free month

in 2017:

- the winners of the campaign in Jesenice registered 0 workplace injuries, compared to 7 the year before
- the winners of the campaign in Ravne na Koroškem registered 1 workplace injuries, compared to 2 the year before
- 11 out of 12 shops that we monitored in Jesenice registered at least one accident-free month
- 11 out of 12 production shops in Ravne na Koroškem registered at least one accident-free month



Decrease in lost time injury frequency rates - during the campaign

Communication goals of the campaign

a) Raising employee awareness on the importance of occupational health and safety: directly or indirectly include at least 75% (2,550) employees from the 5 companies in the campaign.
Goal achieved:
   - 2,700 employees reached through monitoring the goals in the shops through the so-called silhouettes
   - 334 employees reached via workshops in 2016 and 390 employees in 2017
   - 122 employees reached via sparks in 2016 and 44 in 2017
   - etc.

b) Provide communication support for systematic measures aimed at improving professional health and safety in 2016, thereby raising employee awareness on the necessity of performing these activities. Goal achieved – the communication campaign included all systematic measures and occupational health and safety activities of individual companies and brought them closer to the employees.

SIJ - Slovenian Steel Group d.d.

Award: Safety
Category: Accident analysis, Safety training, Skill training

"Working safely, staying healthy" - employee awareness health and safety

c) Raising the awareness of leaders, who can have a vital contribution to the reduction of sick leaves and the lowering of the number of workplace accidents. Partially achieved – the heads were included in the Minute for Safety workshops, but raising awareness is a long-term process.

d) Raising awareness for the most common causes of workplace accidents and how to avoid them. Goal achieved – through the visualisation of workplace accidents and advice for safer work shown on the so-called silhouettes.

Aperam

Award: Safety
Category: Safety training

Health and Safety Mind Set Change

Challenge

In the past following accident investigations we concentrated our efforts mostly on the physical conditions (machine guarding, PPE, etc...) but there was one aspect we were not addressing enough, the behaviours that lead to these accidents and how to effectively make the mind set change towards a safer company. In our quest to reach H&S Sustainability, our accident statistics, in 2016, demonstrated that the majority of our accidents (53%) occurred in 2 locations (Chatelet and Gueugnon). We decided to concentrate our efforts on these 2 locations (at first) to try to effectively change the behaviours that causes the accident, the mind set in H&S.

We decided to attack the problem by developping an Aperam specific program we called SAFE.

Action

Implement the SAFE training program (5 consecutive days of in-class and shop floor training using their day to day activities) for all the employees at our 2 problematic sites (Chatelet in Belgium and Gueugnon in France). The training program started in July 2016 and continues today.

The SAFE training program targets the employees

ability to see the hazards on site and helps develop their skills of interaction with their peers in order to solve the issues identified. The SAFE program also allows the employees to come to grips with the consequences of their actions and or their inaction.

The 5 days are organized in the following manner:

Day 1: Workshop on Inspiring Change

Day 2: Recognizing Shop Floor Hazards and Lowering Risk Tolerance

Day 3: Speaking up: High-Impact Engagement

Day 4: Preventing Fatalities. Shop Floor Assignment

Day 5: Renewing Committment to a Safe Workplace and recognition of their mind set evolution towards Safety

Each 5 day workshop brings together 15 employees, white and blue collar, from

Aperam

Award: Safety
Category: Safety training

Health and Safety Mind Set Change

different departments of the plant (production, maintenance, shipping.....) and is fully supported by the Plant Management.

This training can and is immediately put into application by the participants in their own work areas. Throughout this 5 day training session, participants have the opportunity to exchange openly with the Top plant managers on their H&S concerns and their proposed solutions to hazard elimination.

Outcome

After 1 ½ years of deploying the SAFE program at these 2 plants, we recorded a 42% reduction of accidents at Chatelet and a reduction of 57% of accidents in Gueugnon.

We noticed the employees who had participated in the training were more open in discussing H&S and their concerns with their peers and management alike than before the training. They were also more willing to help in the search and application of solutions.

Following the realization of this successful outcome, we decided to accelerate the delivery of the SAFE program to all Aperam locations worldwide. We developped 20 additional trainers and more than 1000 employees have been trained to date. (59% of Chatelet employees and 42% of Gueugnon employees trained as of end of December 2017)

The SAFE training program has become one of our main H&S initiatives in our quest to reach H&S Sustainability.

Outokumpu

Award: Sustainability
Category: Emissions, Material efficiency

Material efficiency, cost and environmental improvements through pelletising of light scrap

Challenge

The use of light stainless scrap as a feedstock in the electric arc furnace is beneficial as it can generally be melted more efficiently than heavy scrap and is a cheaper source of material for the process. However, light scrap typically takes up a disproportionate volume in the scrap basket, meaning that the basket is full before the load capacity of the transport vehicle is reached, requiring an increasing number of basket charges per furnace cast and hence extending tap-to-tap times. Additionally, as light scraps tend to have a high level of oils and coolants present on their surface, this can result in increased flaring during charging with a resultant increase in furnace emissions. As a result, only a small amount of light scrap per basket charge can be used.

In addition, many of these lightweight materials are pre-consumer scraps with more precise elemental analysis than post-consumer scrap. As a result their use allows steelmakers to better utilise these materials to match the grades of steel intended to be produced.

If a way to densify light scrap was available, then more light scrap could be utilised, providing conversion cost and tap-to-tap time savings, but also having the added benefits of reduced alloy usage and reduced environmental emissions.

Action

During 2016 a pelletising machine was installed at Outokumpu's SMACC site in the UK. The unit comprised a hopper and conveyor system to allow light scrap in the form of turnings to be fed to a compaction chamber. At the chamber, the turnings are pelletised by hydraulic pistons, squeezing coolant and oils from the surface of the scrap and providing a densified material, commonly referred to as a puck. These pucks are then stored in the raw materials stockyard for use in the electric arc furnace.

Outcome

The pelletiser has allowed a 100% increase in the amount of light stainless scrap consumed at SMACC. For the reasons given above the use of light scrap has been historically limited to approximately 20 tonnes per basket charge. Since the pelletiser has been employed, turnings can now be used at a much higher rate; up to 60 tonnes per basket is possible, and their use is only restricted by the selectivity of scrap types in a particular grade.

As the cost of light scrap in the form of turnings is lower than that of solid scrap then the increased use of light scrap presents a significant financial benefit for Outokumpu.

An additional benefit of pelletising is that any coolant or oil contamination on the turnings can be removed during compaction, leading to less organics being emitted to atmosphere during charging. In the first 14 months of operation, a total of 53 tonnes of oil, coolant and rainwater was removed from turnings, reducing emissions but also increasing the energy efficiency and safety of

Outokumpu

Award: Sustainability
Category: Emissions, Material efficiency

Material efficiency, cost and environmental improvements through pelletising of light scrap

the process.

Finally, as all of Outokumpu's light scrap is UK sourced and before the pelletiser was installed there was limited opportunity for its use within the UK, the unit has reduced the commercial export of light scrap to other countries thereby further reducing the environmental impact of its recovery.

Light scrap (turnings) before pelletisation

After pelletisation

ACERINOX EUROPA S.A.U.

Award: Sustainability
Category: Material efficiency

Acerinox project on the use of stainless steel slag

Challenge

Acerinox has presented to Authorities its Wastes reduction plan. Main waste generated is the stainless steel slag and the current destiny is landfill. The challenge is finding a use for the stainless steel slag and reducing the landfill. This challenge meets the Zero waste policy and it's part of the current circular economy promoted.

Action

Since the 80's Acerinox is supporting several initiatives on stainless steel slag that try to change the destiny of landfill. In 2017 Acerinox carries out a project with the University of Córdoba (Spain) on the reuse of stainless steel slag. The project develops tests and compares the stainless steel slag with other materials already in use, mainly in buildings applications. For the first time the results are positive and show future steps to be followed.

Outcome

The project has presented evidences that the stainless steel slag generated by Acerinox may substitute a percentage of cement in the manufacturing of building conglomerate.

Acerinox is running a second phase project focusing on a concrete use to be presented to Authorities for approval.

There is no experience in the use of stainless steel slag in Spain and Acerinox is contributing and providing support to this use. In 2017 the first Spanish Slag Congress has been held and the Acerinox project has been presented. Acerinox has recently signed a new contract on slag research with the National Research Centre.

Nippon Yakin Kogyo

Award: Sustainability
Category: Material efficiency

Reducing packing material waste

Challenge

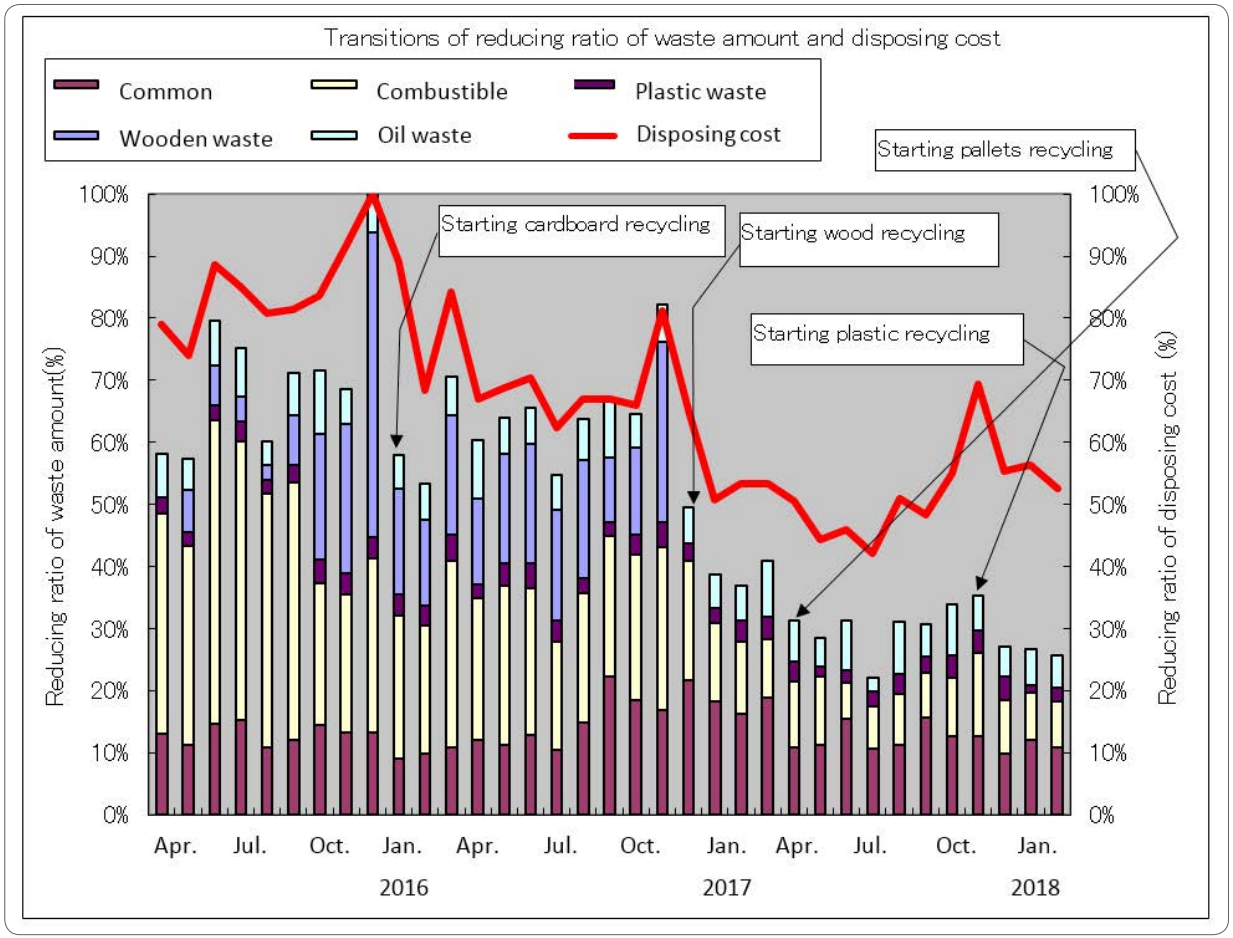
Purchasing involves several kinds of packaging materials such as pallets, cardboard, flexible container bags, stretch film and clamping bands. We had disposal costs of several million Japanese yen per month.

Action

We sorted wooden pallets by size for reusing in our plant or for selling. Regarding the broken wood pallets, we sold them as a fuel for biomass power generation systems, similarly, with regards to plastic pallets we sold them for a recycling. Regarding the cardboard, we installed recycle boxes in our plant and sold them for recycled pulp. Furthermore, we sold flexible container bags, stretch film and clamping bands as plastic materials.

Outcome

We have reduced both the waste and the disposing costs by half. The moral of employee about waste or recycling has improved.



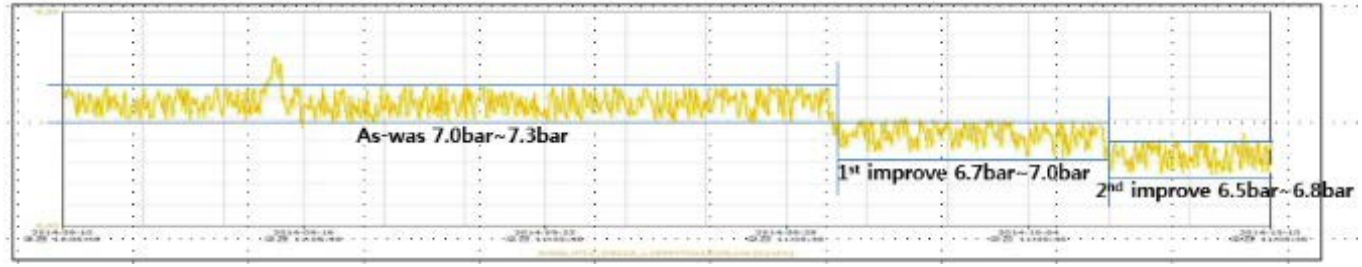
POSCO

Award: Sustainability
Category: Energy intensity

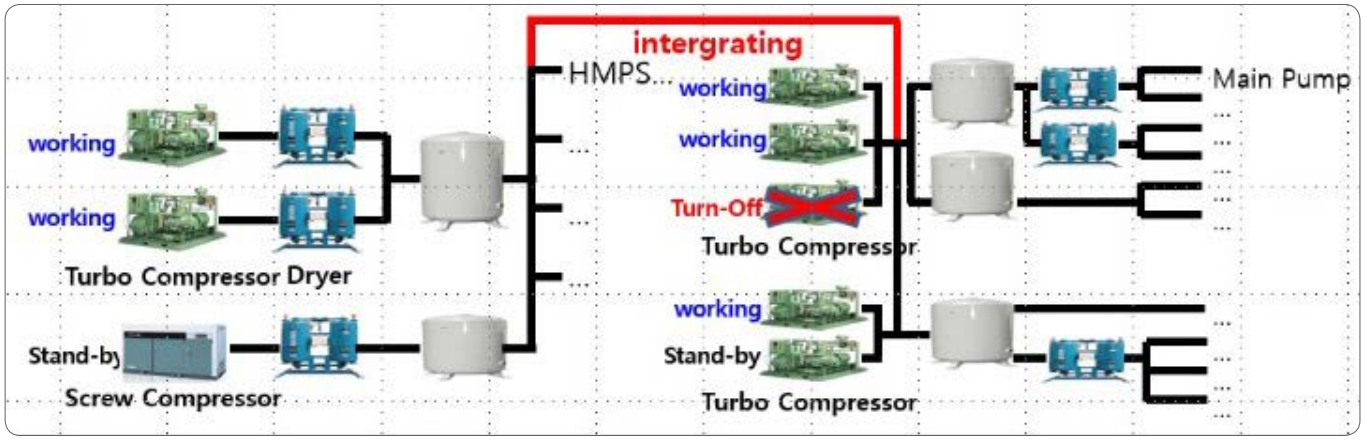
Reduce the power consumption of air compressor

Challenge

We operated several air compressors to supply compressed air, but there was a lot of waste. There were two main reasons for wasted power consumption in air compressors. The first reason is excessively pressurized air production for operational stability (Required pressure 5.4bar, Actual supply pressure 7.2bar). The second reason is operating the separated air compressors for each process. (Surplus compressed air is dissipated in each process).



Activity 1: Air supply pressure



Activity 2: Air supply system integrating

Action

To prevent waste, we performed two activities.

1. By optimizing the operation pressure of each air compressor, the supply pressure is reduced from 7.2 to 6.6 bar. As a result, the compressed air tank outlet pressure was 5.8 bar, which satisfied the required pressure of 5.4 bar.
2. We have integrated a compressed air supply system to prevent the loss of excess compressed air. The turbo compressor we are

POSCO

Award: Sustainability
Category: Energy intensity

Reduce the power consumption of air compressor

using has the characteristic that the excess compressed air is dissipated. So, We have integrated the air supply system so that it can be used in other processes when excess compressed air is generated.

Outcome

As a result of performing two activities, we were able to turn off one air compressor at each factory.

- Quantitative effect - Electric power saving U$ 1.3 million/year
- Qualitative effect

  - Reduced Compressor repair costs
  - Improved operational stability (since compressed air can be supplied to each other, it is possible to prevent occurrence of operational trouble even in the event of an air compressor failure.)

Columbus Stainless Pty Ltd

Award: Sustainability
Category: Emissions; Material efficiency

Columbus Water Recovery

Challenge

Columbus Stainless is situated in a dry and water poor area requiring that the water resource of the area be utilised optimally and be protected from discharges into rivers that may adversely impact on the quality of the water in the river.

Additionally, in the water catchment in which Columbus lies, the water resource is already over utilised with potential supply problems if all water is not used sparingly.

With these factors in mind, Columbus has tried to achieve as far as possible self-sufficiency in the process water supply for its operations and at the same time to run the operation as a zero effluent site. Key to this has been the ability to recover water from effluent for reuse purposes.

Action

With the above objectives, Columbus has implemented an effluent management system where all effluent is treated rather than being discharged with the aim of the treatment process being to recover as much water from the effluent as possible allowing for the reuse of this resource.

To understand how the water recovery is achieved, it is first necessary to understand effluent management at Columbus.

Storm Water Management

The Columbus site has been divided into two areas: firstly those areas of the site which are vacant or on which operations are of such a nature that the run off associated with rainfall on the site will not be contaminated. Run off from this 'clean' area is allowed to flow off the site and is diverted from the second area of the site, the so called operations area. The operations area of the site is that part of the site from which rainfall run off may be contaminated given the operations occurring in this area.

Any run off originating from the operations part of the site is contained in dams and not permitted to leave the site. These dams are sized that run off associated with any rainfall up to and including a 24 hour storm water event of 1 in 50 year severity is retained.

Furthermore the run off originating from the operations part of the site is separated into 'first flush' run off and clean run off. The first flush run off is as the name implies, the run off derived from the initial run off during a storm event particularly after a long dry season. This run off is contained separately from any subsequent run off with the distinction being that the first flush containment will capture the possibly contaminated first flush while subsequent run off is clean and is contained separately in 'clean' dams, see photograph captioned 'Clean Storm Water Dam'. The difference in quality between the two categories of water is that first flush water may need treatment before it can be used as process water make up while the clean run off is

Columbus Stainless Pty Ltd

Award: Sustainability
Category: Emissions; Material efficiency

Columbus Water Recovery

likely to be of good enough quality that it can be used as process water make up as is.

Water contained in the first flush dams, see photograph captioned 'First Flush Containment Pond', is analysed and depending on the quality will be directed for treatment or if clean enough to be used as is, the water can be directed to the 'clean' dams as a source of process water make up as is.

First flush containment pond

Treatment of poor quality first flush water is done together with 'weak' effluents described below.

Weak Effluent Management

Weak effluent is considered to be effluent that is contaminated because of slightly elevated TDS levels. These effluents are typically derived from cooling system blow downs, boiler blow downs, general facility wash water and the like. This water is put to contamination dams in anticipation of treatment. As explained earlier storm water run-off needing to be treated is also put to these operations dams. Treatment consists of solids removal using flocculation and filtration, and then a biocide treatment before the water is treated in reverse osmosis (RO) units to remove dissolved salts. The water recovered from the reverse osmosis units is available for process water make up while the salt containing reject water from the RO units is added to the treatment process for 'strong' effluent.

Strong Effluent Management

Strong effluent is poor quality effluent with high TDS levels and also dissolved metals as contaminants of concern. Typically these effluents originate from the pickling operations at Columbus but also come from regeneration of ion exchange columns at the water demineralising operations at site. The effluents typically have a TDS of 45g/L and a pH of 2.

Neutralisation is the first step of the treatment process, followed by treatment to precipitate all the metals present as metal hydroxides.

First flush containment pond

Columbus Stainless Pty Ltd

Award: Sustainability
Category: Emissions; Material efficiency

Columbus Water Recovery

Second stage evaporator

Second stage evaporator

Following this the solid precipitate is filtered from the treated effluent.

The filtrate is then put to a vapour recompression evaporating unit, see photograph captioned 'First Stage Evaporator', where the water is recovered as a condensate which can be used as process water make up. The remaining salty brine in the evaporator is purged from the unit and undergoes further evaporation in a separate evaporation unit; see photograph captioned 'Second Stage Evaporator', to concentrate the brine further. This concentrated brine consisting mainly of calcium nitrate is sold to the fertilizer industry. Condensate from this further evaporative step is not suitable as process water make up but is instead added back to the filter feed of the neutralisation process.

Columbus Stainless Pty Ltd

Award: Sustainability
Category: Emissions; Material efficiency

Columbus Water Recovery

Outcome

Water Recovery

Overall a water recovery of approximately 95% is achieved on the effluents arising from the Columbus operations, achieved as follows:

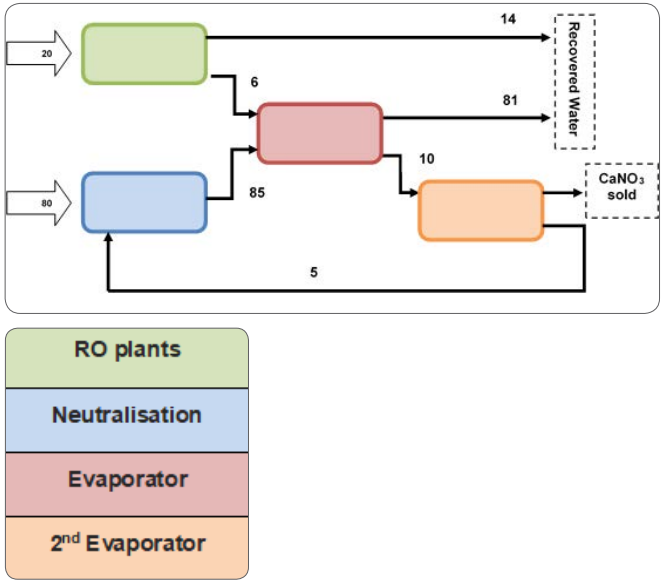
i. In the RO plants a permeate recovery of approximately 70% is achieved with the 30% reject being put to the strong effluent system.

ii. At the first evaporate step of the strong effluent system a water recovery of approximately 90% is achieved.

iii. The remaining 10% from the first evaporator step is put to a subsequent evaporator step where water is recovered at approximately 50%. This recovered water is put to the neutralizing step of the strong effluent system.

Given that part of the feed to the RO plants is derived from rainfall, the proportion of the total effluent that is treated in the weak system relative to the strong system is rainfall dependent.

Under fairly typical rainfall conditions where the weak system treats 20% of the total effluent treated, the water recovery can be depicted as follows:



As can be seen, under these circumstances a water recovery of 95%(14 + 81)is achieved with the remaining 5% water leaving the site as water associated with the calcium nitrate solution that is sold to the fertilizer industry.

This ability to recover water from storm water runoff and from treated effluent has meant that at Columbus over the last six years on average 75% of the process water make up requirement has been obtained from these sources.

Not only does this mean Columbus need only draw a quarter of its water requirement from the local water resource but also that with no need to discharge any effluent, the local water resource quality is not affected by the Columbus operations.

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About ISSF

The International Stainless Steel Forum (ISSF) is a non-profit research and development organisation which was founded in 1996 and which serves as the focal point for the international stainless steel industry.

Who are the members?

ISSF has two categories of membership: company members and affiliated members. Company members are producers of stainless steel (integrated mills and rerollers). Affiliated members are national or regional stainless steel industry associations. ISSF now has 65 members in 25 countries. Collectively they produce 80% of all stainless steel.

Vision

Stainless steel provides sustainable solutions for everyday life.

More information

For more information about ISSF, please consult our website worldstainless.org.

For more information about stainless steel and sustainability, please consult the sustainablestainless.org website.

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