

SUSTAINABLE
STAINLESS



Safety and Sustainability Awards 2019



Caring for our people and our planet



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Foreword by the Secretary-General



This year marks the 10th anniversary of the ISSF's Annual Awards for Sustainability and Safety. It is very encouraging to note how the issues of Safety and Sustainability have acquired fresh importance among the

several management issues with which CEOs and their teams are faced today. The old adage that nothing is more important than the safety of the people who work for the company has likewise acquired a freshness that lends it credibility. In this regard, it is particularly pleasing for me to note that the slight improvement in entries for the Awards which I reported last year has continued this year, although there are still many members who do not enter their projects into this competition. That is a pity, because the more entries we receive, the more believable will be our claim that safety remains at the forefront of our industry's management. I have said this before, but it bears repeating – all of our

members are doing good work to improve their own standards of safety and sustainability and they must all have stories to share with other members. And remember, you cannot be eligible to win an Award if you have not entered the competition.

This year we received seven entries for the Sustainability Award (five last year) and a stable fourteen entries for the Safety Award (fifteen last year). The standards of the entries continue to improve, once again making the task of judging the entries very difficult. Once again we had the benefit of the widespread views of 7 judges who each scored every entry independently and their final scores were averaged to find the winners.

There is excellent work being done in these vital areas. Tell us your stories. Our Annual Report on the Safety and Sustainability Awards should give a solid message to the regulatory authorities and the general public about the strong focus our industry places on the safety of our people and the protection of our environment. It also enables us to publish

these messages so that our members may learn from each other. Our Awards Programme is designed to reward excellence and commitment, but also to be an incentive for all of our members to benchmark themselves against best practice.

This year's Award Winners have been selected in first, second and third placed categories and they are all worthy winners. But there are no losers in this type of competition. All of the entries for this year's Awards have been worth-while and they are all deserving of recognition. For this reason we publish all of the the submissions in the Annual Safety and Sustainability Awards Brochure, in the hope that the best ideas may be duplicated elsewhere.

John Rowe
Secretary-General
International Stainless Steel Forum
Chicago
May 2019

Bahru Stainless Sdn Bhd

Award: Safety
Category: Safety Training

Reduce LTI Rate via Safety Awareness Training Program

Challenge

According to 2017 injury Analysis by type of incident nature, there are about 68% frequency of injury was due to "Slip/Fall", "Cut-by" and "Stuck-by" while performing the job tasks. The root causes were identified due to human negligence or work in rush, who fail to observe the hazards and adhered to basic safety rules. The findings reveal that the need on how to increase the level of safety awareness and safety compliance in day to day plant operations.

Action

Several Safety Awareness training programmes were identified as the Standard Training Modules for year in 2018. These include "General Safety Rules" such as forklift operational safety, overhead crane operational safety, confine space entry, job safety assessment, "LOTO training", "Permit To Work", Introduction to Behavioural Base Observation and etc. The programmes were planned to be 100% in-house conducted include the safety instructors. In total 58 training classes were conducted in 2018. About 66% of the training scope was allocated to "General Safety Rules" related topics, "Behaviour Base Observation" and "Permit to Work". The status of training participation was tracked for individual work stations and information was shared throughout the plant by weekly basis. The training activity is targeted to be in continual basis and aimed to cover 100% of participation in all modules from each respective workstation.



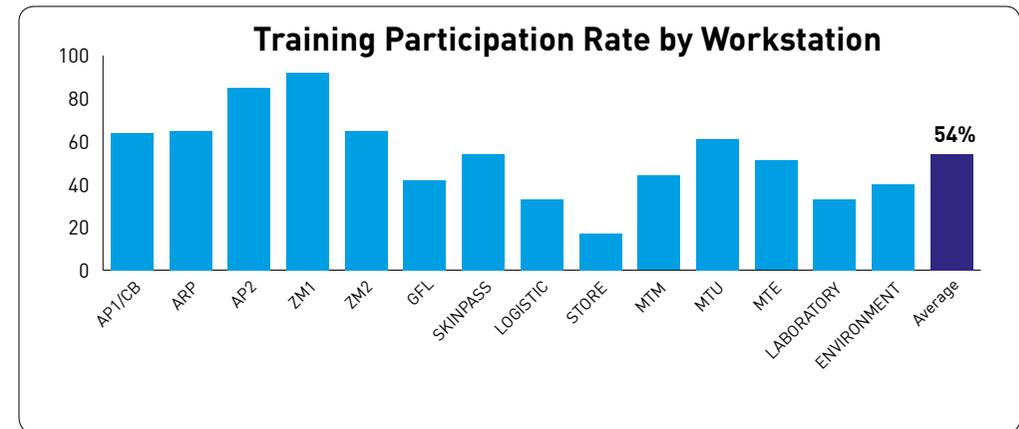
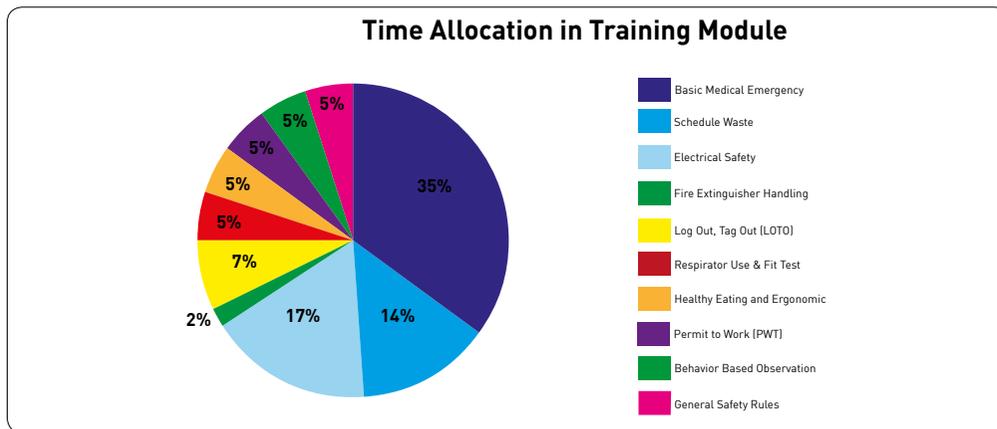
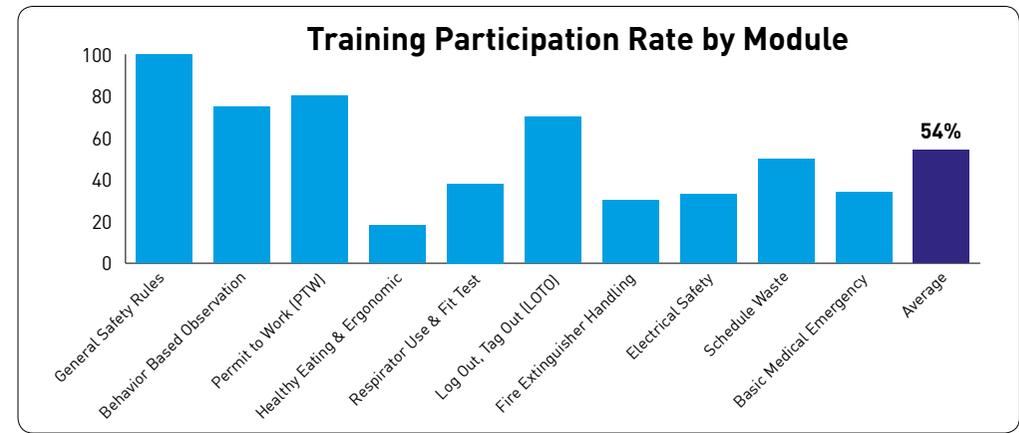
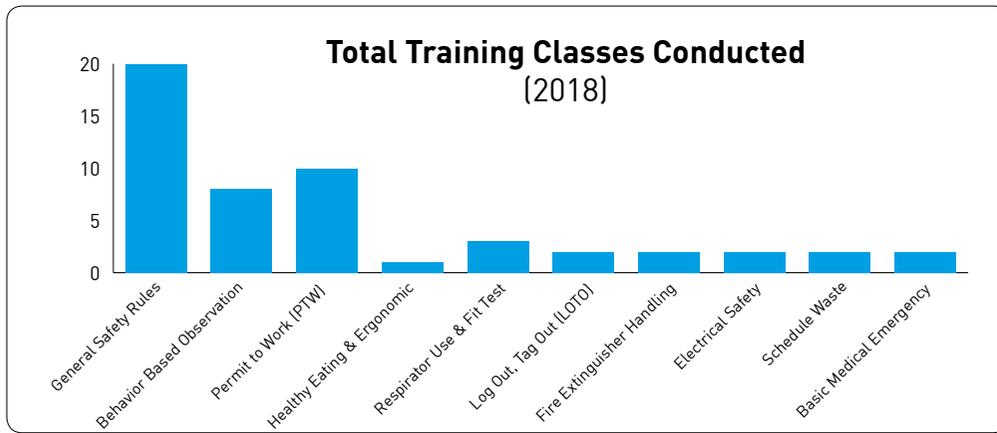
Bahru Stainless Safety Awareness Training



Bahru Stainless Sdn Bhd

Award: Safety
Category: Safety Training

Reduce LTI Rate via Safety Awareness Training Program





Bahru Stainless Sdn Bhd

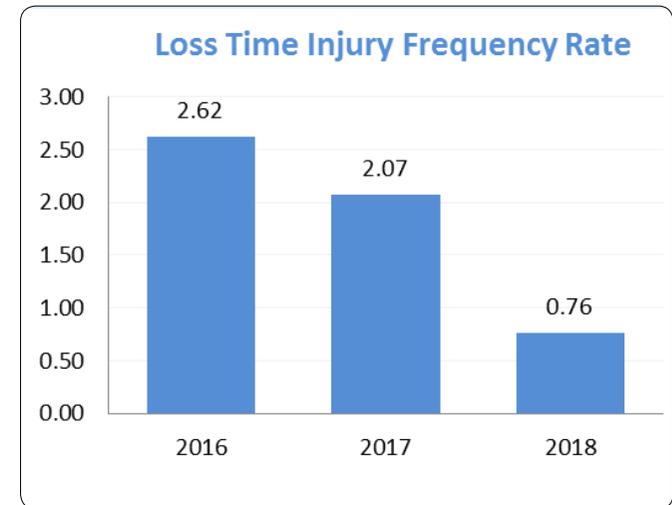
Award: Safety
Category: Safety Training

Reduce LTI Rate via Safety Awareness Training Program

Outcome

Employees have noticed better understanding on their general duty and responsibility in safety including the PPE compliance as part of their job obligation. Safety initiatives had no longer top down approach as employees also start taking part in safety ideas suggestions through activities such as Hazards Hunt using the HIRARC (Hazard Identification- Risk Assessment and Risk Control)

method.
 Loss time injury frequency rate had reduced by 63% from average 2.07 in 2017 to 0.76 YTD 2018. In week 51, 2018, total Zero Loss Time Injury man hours had recorded 937,061 since 17th April 2018, a new all-time historical record as compared previous record of 429,469 man hours.





North American Stainless

Award: Safety
Category: Workplace Improvement

Reduce Fork Lift Incidents

Challenge

Over the past couple of years we have noticed an increase in incidents involving fork lifts primarily property damages, but we have had a few injuries and near misses as well. Our fork lift material movement is performed mainly by contractors, but we do have NAS employees that operate fork lifts to perform some operational tasks. We have worked closely with our contractors to ensure that they are properly training their employees and we have strict forklift operation policy and guidelines in place. We have installed blue lights on the front and back of our fork lifts that project out in front of them and behind them when they are traveling and created designated walking paths in our mills. This alerts pedestrians or those working in the area that a fork lift is approaching or is in the vicinity. With proper training and a strong fork lift policy and the blue light system in place we have had a 30 percent reduction in fork lift incidents, but we still need to find a way to eliminate these types of incidents from occurring.

Action

Training and awareness for all persons in and around the mills is very important. Employees need to be vigilant when walking and working while on site. We have not only trained our fork lift drivers, but also our employees in pedestrian safety. We have annual fork lift safety training for all of our employees

that includes pedestrian safety and have issued various toolbox topics on safe fork lift operation and pedestrian safety as well. Contractors are trained by their company on safe fork lift operation and also certified to operate the equipment. In addition to training, we have implemented some physical changes. We have set up designated walkways that

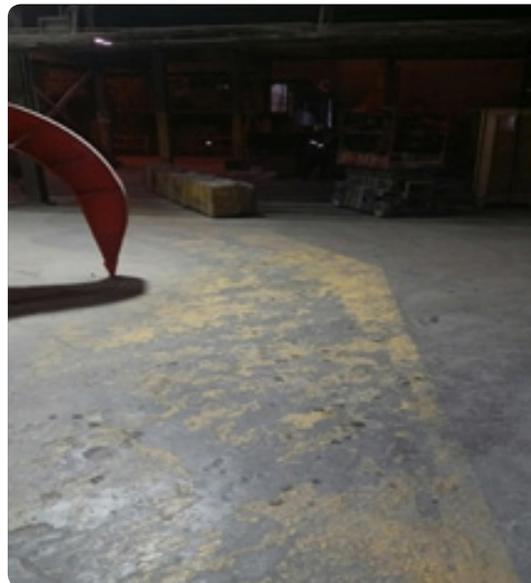


Photo before notification system



Photo after notification system



North American Stainless

Award: Safety
Category: Workplace Improvement

Reduce Fork Lift Incidents

are color coded to correspond with the hazards that are in the area (overhead cranes, mixed traffic, safe and do not walk). The walkways are placed to limit mobile equipment and pedestrian interaction as much as possible. We have also added a blue light system to the fork lifts as well. This shines in front of and behind the fork lift giving pedestrians an early warning that there is a fork lift approaching. Even with the implementation of these changes we still had issues.

In an effort to continually improve fork lift safety on site, we have installed a new fork lift projection system. The system works like a radar system with a stationary projector located in the pedestrian areas and a radar system attached to the fork lift. We positioned these projectors around main walkways in the mills where a large amount of fork lift operations take place. When a forklift gets near a designated walk way the camera picks up the radar signal from the fork lift and it projects an alert onto the walkway so pedestrians are aware that a fork lift is in the area.

Outcome

Since we have placed the cameras around the facility we have noticed a lot more awareness from our employees in areas where we have a large amount of fork lift operations. In addition, our fork lift drivers have started to slow down and pay more attention to their surroundings. The system is new but we have already started to see a decrease in the amount of fork lift incidents around the plant.

North American Stainless

Award: Safety
Category: Workplace Improvement

Increase Awareness of Slag Trucks on the Hot Road

Challenge

The road behind our Melt Shop is called the Hot Road due to the type of equipment that is operated on this road. This is the main road used by the slag truck to move hot slag from our Melt Shop to the slag barn. While the hot road is used mainly by the slag trucks, there are times that it is utilized by others. For any other persons or equipment to be on the hot road they must have a hot road access pass. To receive this pass, the person must be approved by Safety and the Melt Shop Manager. Once they receive the pass they must place it on the front window of the vehicle or fork lift. The road is policed by security and anyone on the road without the pass will receive a ticket. Very few hot road passes are issued as we want to limit as much vehicle traffic as possible on the hot road.

With this step we limited those driving directly on the hot road, but the way our roads are designed we still have a few areas that mix slag pot traffic with general traffic. We have an intersection where the main road through the scrap yard meets up with the hot road. There is a stop sign at this intersection, but we have at times had people not coming to a full stop at the sign with the slag trucks in close

proximity to the intersection, thus causing several near misses.

We needed to find a way to increase the awareness around this stop sign, so people will know if there is a slag truck in the area before pulling into the intersection.

Action

Since limiting the amount of traffic in the area was difficult at times and administrative controls were not as effective as we wanted them to be, we started looking for some additional controls that we could install to help improve traffic safety in this area. After looking at several options the group decided on the Symeo alert system. This system includes installing a beacon on the slag truck that will only operate when



Picture of the truck and the light above stop sign.



Close up picture of the light.



North American Stainless

Award: Safety
Category: Workplace Improvement

Increase Awareness of Slag Trucks on the Hot Road

the truck is running in gear. When in operation, the beacon will transmit a signal to a strobe light located on the stop sign. When the strobe light is flashing, this will indicate to oncoming traffic that there is a slag truck in the area. The pros of the system are that there are no photo eyes, lasers, etc. so the outside elements (rain, snow, dirt, dust, etc.) will not interfere with the system. This system has been placed on stop signs at two different intersections leading onto the hot road.

Outcome

Since the Symeo system has been installed we have had fewer near misses in these areas. We have also noticed that those driving in the area are paying more attention to the posted signs and are more aware of the hazards in the area. Another benefit is that it also makes the stop light more visible at night and during inclement weather.

ACERINOX EUROPA S.A.U.

Award: Safety
Category: Workplace Improvement

Exoskeleton

Challenge

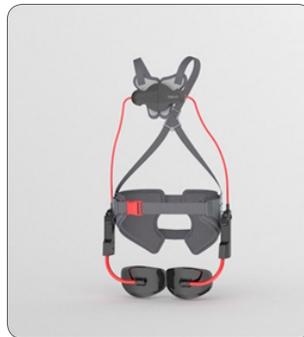
The main causes of accident in a refractory section in the Melting Shop are related to movements and postures of operators during refractory construction operations such as laddels and AOD converters. Those accidents produce musculoskeletal injuries on workers.

Action

To solve the problem Acerinox Europe has developed a specific project using an EXOSKELETON in cooperation with a Spanish engineering company leader in ergonomics. Two different types of design depending on different assembly phases.

The first type of design is used when an operator is mounting bricks in squatting position, such as the construction of the bottom of laddles and the bottom of AOD converters (Exoskeleton 1).

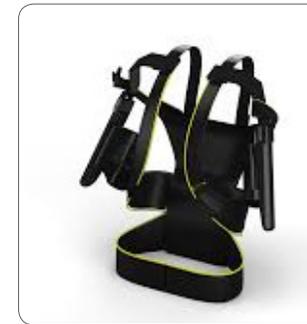
The other type of design is used when an operator is mounting bricks in a position higher than the shoulders, such as the construction of wall of laddles



Exoskeleton 1: Picture of the first type of exoskeleton that was developed, for an operator that is mounting bricks in a squatting position.



and the bottom of AOD converters (Exoskeleton 2).



Exoskeleton 2: Picture of the second type of exoskeleton that was developed, for an operator that is mounting bricks in a position higher than the shoulders.



Outcome

In the refractory section, accidents have been reduced by 80%. The benefits are clear: decrease accident rates, improve the ergonomics, safety and comfort of operators, improve the quality of the job, etc. Operators have a proactive approach to use the exoskeleton.

NIPPON YAKIN KOGYO

Award: Safety
Category: Workplace Improvement

Prevention of heat stroke for Argon Oxygen Decarburization (AOD) process

Challenge

The operating floor for the AOD process is located on a floor higher than the ground floor. Regarding heat stroke, there are three key issues to the operation.

1. The melting shop is at a high temperature due to the radiation heat arising from the melting process.
2. Because the working floor for the AOD process is located above ground, hot air flows onto the floor from the surrounding area.
3. Due to the two issues mentioned above, the operators work in high wet-bulb globe temperatures (WBGT) of above 31°C. These situations can lead to a high risk of heat stroke for the workers in the AOD process.

Action

In order to cool down the temperature on the working floor for the AOD operation, we installed equipment comprising bellows and air blowers which bring air from outside of the melting shop onto the working floor (figure 1).

Outcome

Following this installation, the WBGT fell from 31°C or higher to between 25°C and 28°C. In this way, we have been able to reduce the risk of a heat stroke.

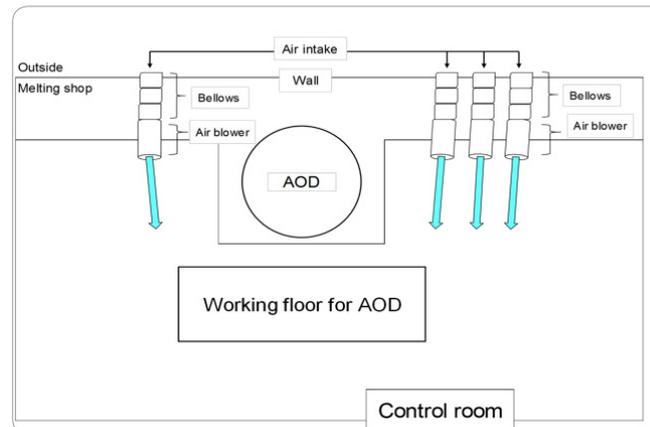


Figure 1: layout of the AOD

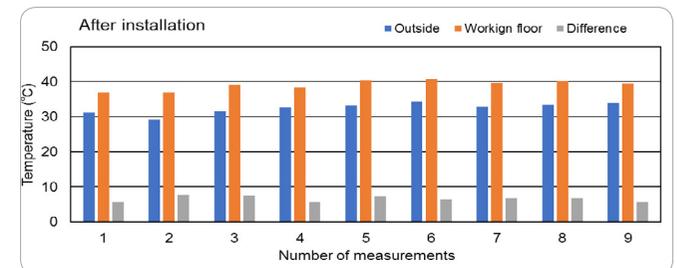
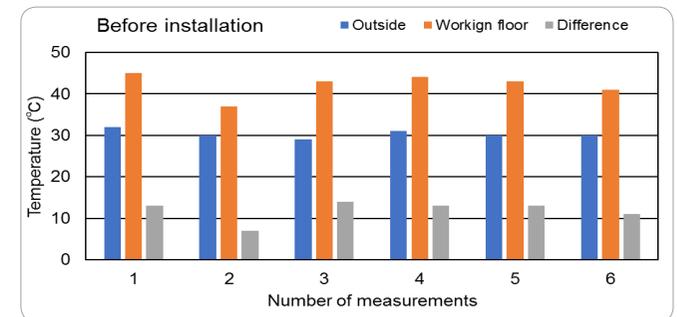


Figure 2: the average difference between outside and the working floor.

Before installation: 11.8°C

After installation: 6.6°C

→ The difference has improved by 5.2°C



JFE Steel Corporation

Award: Safety
Category: Workplace Improvement

Detection of the safety zone by AI technology

Challenge

“Employees enter the unsafe zone”
JFE-steel has several stainless pipe making lines. The unsafe zone (where a pipe and an employee get too close) changes because the length of the pipes differ in the factory. Therefore there are worries that employees enter the unsafe zone by mistake.

Action

“The development of human detection by AI technology”
We developed a human detection system by AI technology. As we made the AI system to recognise the safe and unsafe zones, the camera (that is set up in the factory) with the AI system can detect the presence of a human being. Therefore if someone enters an unsafe zone, they will be alarmed by the AI system
“Now , you are in an unsafe zone”

Outcome

Although our AI system is still under examination, we expect that this system contributes to suppress unsafe actions from our staff.



Photo example of the detection by the AI system

Columbus Stainless

Award: Safety
Category: Safety Training

Safety Health and Environmental e-learning program

Challenge

The Company is visited by many people throughout any month. All Visitors to the Business must be booked on the scheduler by the Responsible Columbus Representative. On arrival, all visitors must then attend the Visitor's Safety, Health and Environmental Induction. This process includes registration at reception and watching the Induction Video which must be set-up by the receptionist and can only be done once the Visitor is on site. This often results in the late arrival of the visitors for the actual appointment in the Plant. The Visitor's Knowledge and understanding is not tested after watching the Safety, Health and Environmental Induction Video.

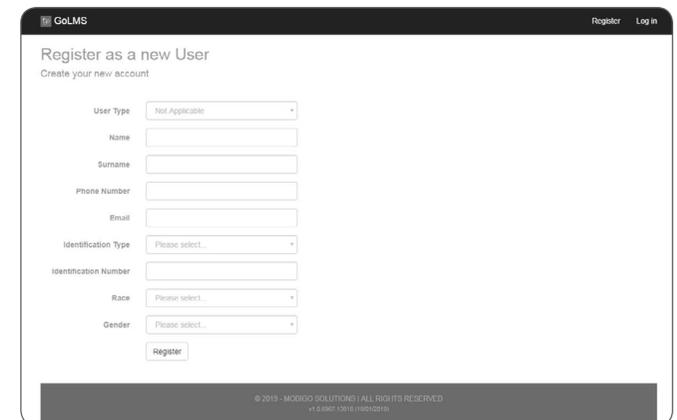
Action

After Consultation with service providers, we have acquired an e-learning program. Visitors will be sent an e-mail with the Visitor's Appointment confirmation as well as a link to the e-learning web-site. Once registered, the Visitor can watch the Safety, Health and Environmental Visitors Induction Video on any mobile device or computer. A Questionnaire was also



LMS Landing Page

added to the e-learning system to test the knowledge and understanding of the Visitor on the Safety, Health and Environmental Induction video. The question base contains a host of different questions and is randomized for every test to ensure that each visitor has a unique test. Some of these questions are compulsory for all tests. Once the Visitor has successfully completed the Induction, he or she can make a print-out of the Competency Certificate and hand it in on arrival at the reception. Alternatively, the receptionist can



LMS Register Page

confirm competency on the system.



Columbus Stainless

Award: Safety
Category: Safety Training

Safety Health and Environmental e-learning program

The screenshot shows the 'Assessment Results' page for 'Visitors Induction' in a GoLMS system. The page includes a search bar with 'Visitors Induction' entered, a title 'Assessment Results for Visitors Induction', and summary statistics: Test Uploaded on 10/12/2018 11:55:11, Allowed Attempts Unlimited, Pass Mark 0%, Total Passed Attempts 13, and Total Failed Attempts 5. Below this is a 'Learner Breakdown' table with columns for Learner, Last Attempt Date Time, Result, Final Score, and Number of Attempts.

Learner	Last Attempt Date Time	Result	Final Score	Number of Attempts
Columbus Learner	12/12/2018 05:35:31	Passed	5	2
Lukas Van Vuuren	19/12/2018 06:42:11	Passed	0	1
Amanda Gerber 2	15/01/2019 12:57:29	Passed	5	1
Clair Schoeman	15/01/2019 13:16:55	Passed	5	1
Theo Botha	22/01/2019 00:03:45	Passed	5	1
Joe Bloks	22/01/2019 06:12:29	Passed	5	1

LMS Results Page

Outcome

This will streamline the Induction Process, reduce time spent at the reception and reduce reception administration. This will also aid in on-time arrival at the appointment. More importantly, the visitor's understanding and competency will be tested. Looking forward; There are several applications for which the e-learning system can be used. The Contractor's Induction will be made available on the e-learning system and it will assist greatly in the availability of Safety training courses, awareness campaigns, Toolbox/pre-shift safety talks and short safety courses in the business.



Aperam

Award: Safety
Category: Workplace Improvement

Leave the phone in your locker!

Challenge

More and more people use personal cell phones and are constantly connected with the outside world, with their network through social media accounts like Instagram, Facebook and WhatsApp. This connection usually does not end when the workday begins.

A few minutes here and there won't typically hurt a business, but can be a big distraction - and become a very dangerous situation in certain workplaces! For example, employees who operate heavy machinery, drive forklifts, or work in crane areas should never use cell phones while working, since it could create a safety hazard.

The cell phone diverts and makes people less concentrated. This can be FATAL in our plants. At the beginning of 2018 we had within 20 days 2 serious accidents at Aperam due to mobile phones.

The feed-back from our services centers showed us that it is really difficult to get the situation under control with a simple prohibition to use the phone during work hours. This is normal human behavior. As soon as the phone vibrates, you want to look at it. We needed a geographical separation between the private phone and his owner during the work hours. The ban on using personal devices in production

areas is not new by Aperam, but we wanted to go further and implement the ban on having a personal cell phones on oneself during working hours in those dangerous areas.

Action

We divided our actions in 4 stages: Discovering, Concept, Roll out and Monitoring. During the **Discovering stage** we collected information and gave first information about this project: Through an internal survey we checked the actual situation on our sites and asked the site managers their opinion about the prohibition project of wearing private mobile phones for the blue collars. We collected their comments and questions, took them into consideration and answered questions that arose. The local legal aspects were checked by each site.

We sensibilized the workers on the risk of "mobile phones" through information, discussions and workshops. We started an internal communication campaign on this project with articles in the company wide newsletter.

After the Discovering stage followed the **Concept**

stage: We established the rules on the use of cell phones and gave guidance to the sites for the deployment of this project.

Local project managers and local technical support managers were designated, the local unions and/or works councils involved.

With their support the needs of technical and organisational solution, like lockers and company phones, alerting system in case of emergency in the family, dedicated safe cell phone usage areas... should be evaluated and organised. Especially providing the lockers made a real difference. They were equipped with chargers and highly visible in the plants, thus giving an additional incentive to put the phones there.

Company tablets and mobile phones have been compared and tested. They are now associated with certain workplaces and not anymore with people, effectively cutting personal use.

With the support of the communication department posters have been created and translated in all Aperam languages.

The **Roll out stage** began.

17 sites, all service centers from Aperam, started in the summer with the concrete implementation



Aperam

Award: Safety
Category: Workplace Improvement

Leave the phone in your locker!

of this project. Lockers have been installed, safe areas dedicated, tools put at disposal and people instructed.

After 4 months for the implementation we started the **Monitoring stage**.

Outcome

This is what our sites managers say today:

- "It surprised us. Fast deployment, no complaints"
- "It is implemented without any problem and it works"
- "Very good indeed, this action really makes the difference"
- "People increase attention on their tasks. No distraction due to Whatsapp anymore. More productivity, more quality, less human mistakes"
- "Less distracting behaviors on the production. Decreasing conflict situation between workers of old-generation and new-generation."

The outcome of this initiative convinced the Leadership team of Aperam so much that they decided to roll this out company wide, including in the steel plants.



Aperam

Award: Safety
Category: Safety Training

Safety Leadership

Challenge

Since 2016, all Aperam Châtelet staff have followed the Safe training which aims to raise awareness of the importance of safety. A logical new step has been taken with the implementation of Safety Leadership training for management (managers and foremen). After working on the technical and organizational aspects, the human behaviour, as a lever of influence, remains a decisive factor in reducing accidents at work. To generate these behavioural changes, direct authority has shown its limits, other tools must be used. Changing behaviour is something that seems complicated and difficult for the managerial line. How to influence behaviours without using authority? All the levels must be involved in the change process, from the head of the plant to the operators.

Action

The purpose of the two-day Safety Leadership Training is first to inform the managerial line about the scope and limits of each person's responsibility, and then to provide them with modern management tools to involve and empower the workers.

The first day sensitizes management on its role and responsibilities.

- What does the law say?
- What is his responsibility?
- And the employer's one?
- What are the specificities that can be used as a manager (right of withdrawal, risky behaviour...)?
- What are the legal, moral and financial responsibilities?

To illustrate these themes, a realistic accident is presented and analyzed by the participants. Each manager gets a role in the accident and everyone's responsibility is analyzed. Through a role play in a virtual court of law, each participant passes to the judge, who assesses the responsibilities and imposes penalties.

The second day is meant to give 10 powerful tools to change people's behaviour. These tools aim for engaging communication rather than persuasion. Management must move from an authoritarian way to a participative and empowering management.

- "If you want to involve and empower people, you have to stop giving them orders and directives, you have to give them choices."

- "If I have the choice and make that choice, I am responsible for my choice. If I have no choice, I'm not responsible." That's the difference !

The ultimate goal is to ensure that health and safety is perceived as a core value by all staff so that it can be a daily guide in the workplace.

Through role plays, the participants approach the welcoming of a new collaborator, a safety briefing, an individual interview about a deviant and repetitive behaviour. All the animations are then analyzed by the group with regard to the new toolbox.

Outcome

This training has been provided for several years in other companies, national and multinational. Although it is difficult to evaluate the contributory part of this training, the safety results have been systematically divided by three or even 10 in the best case.



Aperam

Award: Safety
Category: Skill Training

Simplify the safety rules communication and the risk perception

Challenge

Lack of effective safety communications to the personnel of Aperam, subcontractors and visitors.

Action

1. Setup and deployment of a safety video to allow access to the worksite
2. Transform the safety training into an online training solution to facilitate access and understanding
3. Communicate on the safety rules by thematic movies showing the right example

Outcome

1. Visitors know the safety rules and notably understand! This is done by showing the right example and with a safety test at the end of the movie. A specific location has been set up at the entry of the plant and the security guard give access only if the test is ok (> 80%). This action helps to strengthen the safety behaviour and spirit that you want that every person has when he/she

enters the site. These are the first minutes that set the safety level that is expected !

2. The subcontractors need to be trained on the safety rules before intervening. Previously, every Monday, a training was done by a safety animator. After it, the worker could go to work. Today, this training is online and it allows to do it quietly without the stress of going to work just after the training. We could observe a real improvement concerning the knowledge of rules and more adapted to today's culture. In complement, this tool allows to have a better control concerning the safe access of subcontractors and simplify the flows and delivery of badge authorizations.

In the same spirit as the safety video for visitors, we have integrated different examples to show the good safety behaviour in front of rules. With the attractiveness of this solution, the workers are more focused and be listening. In the workshop, the operators keep the risks a lot better in mind.

The same action exist for the truck drivers as well.

3. In order to reinforce safety focus on different

themes and to eradicate the risks concerned, a safety action has been set up in using this same philosophy. Every 2 months, a safety video is made on a specific theme. This movie, of about 2 minutes, shows the main behaviour or rules and it is attached with a document (safety notification) which explains the risk and associated corrective action. It is sent to the internal and external personnel and used by the manager during the safety audit. The main goal of this action is to remind all personnel the key rules and helps to all together achieve a focus on the topic.

With theses 3 safety actions, we have started to change the way of risk prevention. Using the videos has become a new tool of communication and allows to have a very high level of risk perception. The safety results of subcontractors are on a good level and theses actions reinforce that trend.

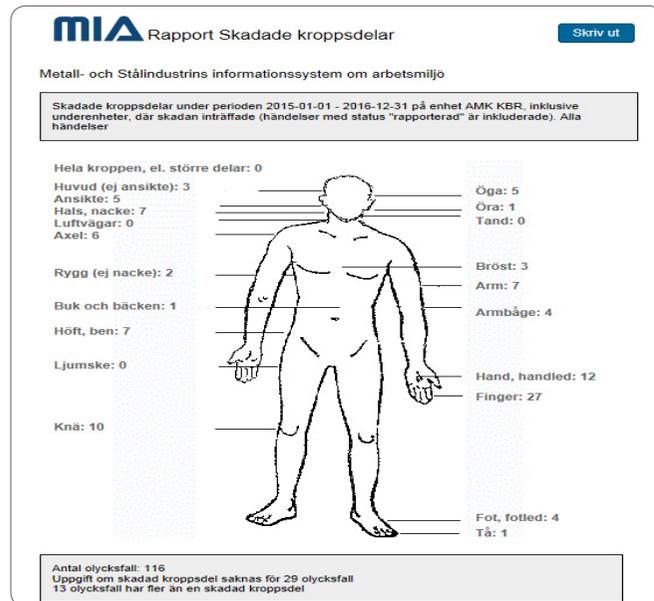
Outokumpu

Award: Safety
Category: Workplace Improvement; Accident Analysis

Minimizing Hand Injuries

Challenge

The KBR Department consists of Annealing and Pickling line, Cold Rolling and Finishing Lines. For several years the Department has suffered approximately 20 hand/finger injuries annually. This is not in compliance with the company's safety ambitions.



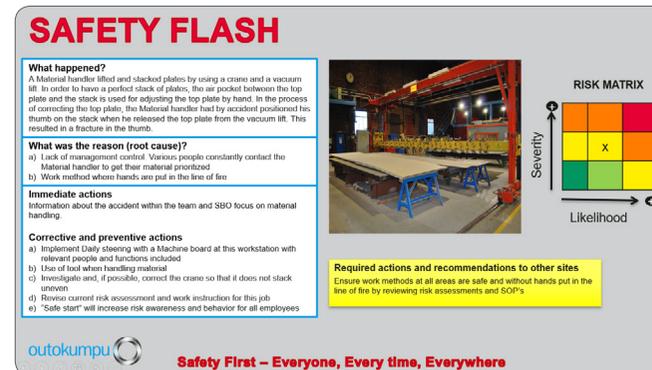
Report on which body parts were injured in an accident.

Action

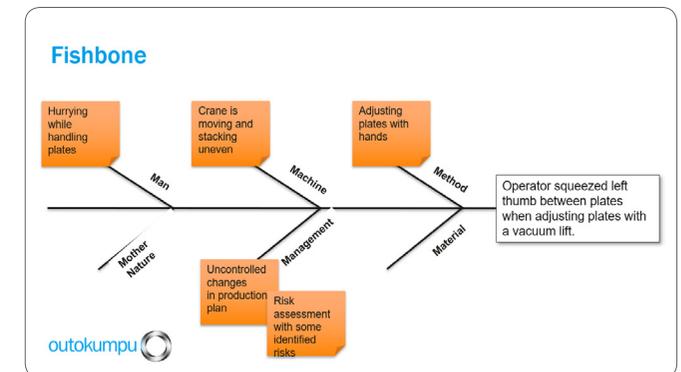
The target for 2018 was to reduce these injuries by 50% unto 10.

Actions were

1. Collection of all available data,
2. Employee involvement in Risk assessments in all jobs where hands are involved
3. Action Plan including handfocused Safety Behaviour Observations, implementing the use of cut protection gloves and a Hand Safety Awareness Week



4. In depth analyses (Fish Bone and 5 Why) of every hand injury occurring

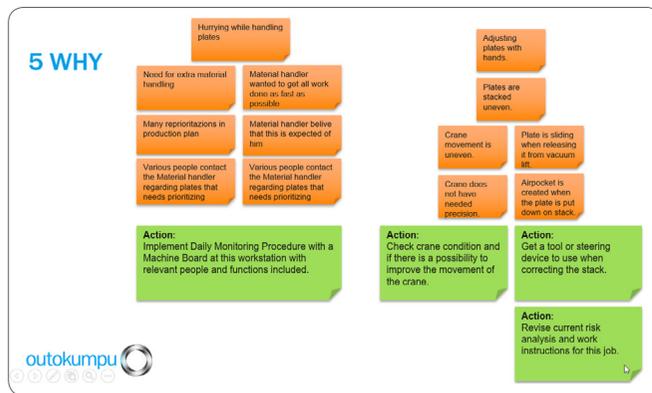




Outokumpu

Award: Safety
Category: Workplace Improvement; Accident Analysis

Minimizing Hand Injuries



Outcome

The target was set to halve the number of injuries for 2018 to 10. Through dedication this target was reached and exceeded. The number of hand injuries was reduced to 6 in 2018.



Outokumpu

Award: Safety
Category: Workplace Improvement

Material Loading and Unloading Improvements

Challenge

Outokumpu realised that throughout its sites that material loading and unloading was one of its biggest hazards after analysing near misses and serious incidents. The main problem was that all sites vary in the amount of activity and the area allocated to perform the task; therefore one solution to address the issue did not work for all sites. This made the problem more challenging.

Loading and unloading of materials can be performed inside or outside which brings environmental challenges or in purpose built warehouses which also can make the job hazardous however they both require the same questions to be asked.

- Who needs to be in the loading/unloading area – and who doesn't?
- Is there enough space around the bays for loading and unloading to take place safely?
- Is the vehicle loading platform the same height as the loading bay platform?
- What is visibility like for the drivers using the loading bay?
- Could people fall from platforms or bays?
- Have the people using the loading bay been trained to do so safely?

Action

The problem was attacked in more than one way using the hierarchy system or error proofing theory.

- Physical Separation
- Technical aids for the loading vehicle
- Technical aids for the pedestrians
- Safe Operating procedure instructions

By addressing the questions above Outokumpu created new ways of working.

Who needs to be in the loading / unloading area and who doesn't?

Physical separation of pedestrians and vehicles is the best solution therefore sites wherever possible after an area risk analysis erected permanent structures, if this was not possible removable structures were used to protect pedestrians and vehicles coming into contact.

Where physical separation was not possible, technical aids for the loading vehicle were introduced with the implementation of the mobile plant "blue light" standard; this is a simple system which requires all vehicles to have a high intensity blue light fitted to the front and rear of all mobile plants.

The advantage of this system is that there is a visible indication of an approaching vehicle and pedestrians

get an advanced warning, especially around blind corners in warehouses. To complement this system vehicles are fitted with additional aids e.g. warning reversing sirens, parabolic rear view mirrors, anti collision sensors and finally camera systems. Pedestrian protection is controlled by an RFID system which gives direct 2 way communication from the loading vehicle to the pedestrian. This system is completely configurable to give audible and physical alerts and creates a 360 degree coverage around the vehicle giving protection with the ability to automatically slow the vehicle down.

Finally a "truck loading standard" was created after Kaizen workshops were held which were attended by key people in the business. This standard not only covered

- Is there enough space around the bays for loading and unloading to take place safely?
- Is the vehicle loading platform the same height as the loading bay platform?
- What is visibility like for the drivers using the loading bay but the arrival on site, preparation and load securing.

During the loading standard discussions driver safety was observed and the question if drivers



Outokumpu

Award: Safety
Category: Workplace Improvement

Material Loading and Unloading Improvements

could fall from bays or platforms was highlighted as a potential risk, therefore Outokumpu now provides driver loading steps as we can guarantee the suitability and integrity of this equipment without having to rely on the transport companies. Also loading platforms were introduced to create a permanent protection barrier around the truck to prevent the driver falling from height or procedures were introduced which instructed the driver to assemble his horizontal bars in "curtain sided trucks" to prevent falling from height.

their vehicles to perform their tasks safely. New site specific procedures which mirror the new standard have been issued and all personnel informed and trained accordingly.

Outcome

Outokumpu now has an agreed standard for truck loading and unloading which is being implemented at all sites. This will create a standardised way of working throughout the company. Pedestrian and vehicle segregation has been addressed and new improved loading areas or re-configured areas have been created to prevent contact between vehicles and pedestrians. Driver safety has increased with the implementation of working platforms and access steps. Mobile plant operators have more technical aids on



Outokumpu

Award: Safety
Category: Workplace Improvement

Risk Visualisation

Challenge

Hazard recognition and subsequent risk assessment have been subjects of major emphasis in Outokumpu over the last few years. We recognised that good quality risk assessments involve shop floor employees and in particular the people actually operating the equipment and undertaking the jobs and tasks. Not everybody can be continually involved in specific hazard recognition and risk assessment and the issue this raises is how to get the risk assessment output and information about the actions taken to all those employees who need to know and understand these.

One way of achieving this is to put a copy of the risk assessment at the point of use and add the controls to the local Standard Operating Practice. However, we recognised that this would require employees to go and look for the output and we wanted a solution that made the outputs obvious to the employee.

Action

We decided to improve our employees' awareness of the risk by making very visual posters to be placed at the points of entry to machinery where employees would enter when working, on the interlocked gates of the guarding fences around the machinery. A copy of the poster can be seen in picture 1 and it contains the following information:

- The top of the poster has a number of photographs of the different pieces of machinery in the sequence they appear in the line. The photograph that is highlighted by a yellow border is of the machine that this poster refers to and it also therefore shows where this is situated in the process line.
- The next section has the name of the machine and its position
- The main photograph is of the machine. Around this are hazard signs which point to exactly where on this machine that the risk exists
- The next section has an amount of instructions on things that must be avoided (all in red and on the top line) and general advice (all in blue on the lower line) for the area aligned as much as possible to the hazards highlighted in the section



Picture 1: copy of the poster



Outokumpu

Award: Safety
Category: Workplace Improvement

Risk Visualisation

above.

- The final section has a general statement about the fact that there may be other hazards in the tasks that people need to be aware of

In addition to this, all of the specific hazards that are highlighted with arrows also have a smaller hazard signs at (or as close as possible to) where the actual hazard exists on the machine.

The intention is that an employee who is required to work on this machine inside the guarding fences will see and read this poster before entering the work area to recognise where the hazards are.

Additionally, when work is being planned for a non-standard task at this point of the machine then all the hazard data for this area can be used to support the creation of the Safe System of Work and the General Permit to Work.

Outcome

Posters are used as a constant source for conversation around safety - not only between employees and leadership personnel but also between colleagues reminding each other of what is important in the area. Additionally, they are also

being used extensively during the permit to work process for maintenance and repairs, especially with 3rd party contractors, to review if risks were all documented and understood in the permit. Overall the posters have led to a higher awareness for the biggest risks in the areas and we are starting to see a benefit in our observation process where we are recognising better practices around the working lines and picking up much less unsafe acts.

NIPPON STEEL Stainless Steel Corporation

Award: Safety
Category: Workplace Improvement

Activities to establish heatstroke-free workplaces

Challenge

Summer in Japan is very hot and humid, and it leads to a high risk of heatstroke which might cause serious symptoms including unconsciousness, organ failure and death. Recently, the number of heatstroke patients has increased as in Figure 1. Since 2009, we have strived to eliminate the occurrence of heatstroke for our employees in the workplaces by implementing several measures, as we reported in 2015.

Figure 1 also shows that most of recent heatstroke patients in our workplaces belonged to contractors, who engaged in non-routine works such as on-site troubleshooting. These works are often operated where the wet-bulb globe temperature (WBGT) meter is not installed, such as culverts and furnaces. The WBGT shows the estimate of the effect of temperature, humidity, wind speed (wind chill), and visible and infrared radiation on humans. It has been quite difficult to perceive the risk of heatstroke for operators in such places. Moreover, these operators couldn't have enough breaks during the worktime, because these non-routine works often should be done in limited time, and there were not enough places for taking breaks around the working area. It

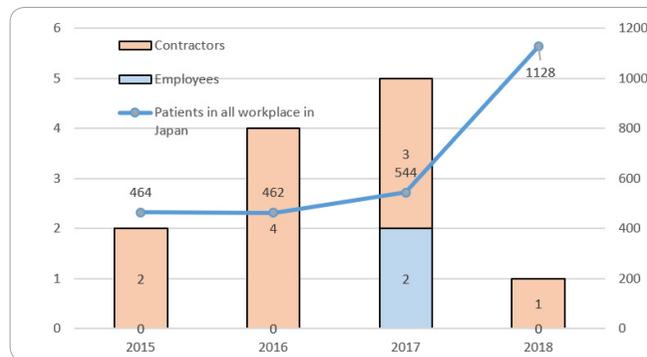


Figure 1: the number of heatstroke patients from 2015 to 2018

was an urgent task to solve these problems in order to establish a heatstroke-free workplace.

Action

Firstly, we thought we needed to establish a system to perceive the heat stress of every operator to eliminate the risk of heatstroke. Therefore, we provided portable WBGT meters for every operator so that they can be aware of the WBGT figure where they are exactly standing (photo 1). This WBGT meter

can also emit an audible alarm if it is in high heat stress condition.

Secondly, as each operator has been able to measure the WBGT values, we have established guidelines to limit the continuous work and how long they should rest corresponding not to judgement by their own experience but to the WBGT figure and work load. Thirdly, we provided operators who work in high



Photo 1: portable WBGT meter



NIPPON STEEL Stainless Steel Corporation

Award: Safety
Category: Workplace Improvement

Activities to establish heatstroke-free workplaces

WBGT conditions with equipment to cool down as shown in photo 2. We have also installed 26 cool houses for contractors who work in severe conditions.

Moreover, as it is also quite important to take enough salt, we indicated the standard of intake corresponding to WBGT, and distributed enough isotonic drink which contains salt to all workplaces.

Outcome

Summer in 2018 was extremely hot and the number of heatstroke patients showed a sharp increase in Japan, more than double compared to 2017. However, only 1 operator from a contractor had a heatstroke in 2018 in our works.

We will continue to introduce measures including the installation of a cool house and cooling equipment. Moreover, we are considering to adopt IT tools to obtain biological information such as heart rate to detect the risk at an early stage. Our goal is to achieve zero heatstroke patients in our works.



Photo 2: cool down equipment



North American Stainless

Award: Sustainability
Category: Material efficiency

AOD Dust Reuse

Challenge

Disposal of AOD dust generation rates containing high dolomitic lime concentrations.

Action

NAS has historically disposed Argon Oxygen Decarburization (AOD) baghouse dust as a hazardous waste. The AOD dust at NAS has a high dolomitic lime (>50%) concentration which makes it difficult to stabilize for disposal in a landfill. Due to the high dolomitic lime content and lower metal content, it has been cost prohibitive to recycle AOD dust for its metal content (unlike EAF baghouse dust).

After receiving approval from authorities, NAS started using the AOD dust as an ingredient in the EAF. The AOD dust is now a replacement for new dolomitic lime by substituting 4 tons of AOD dust for every 2.2 tons of purchased dolomitic lime. The AOD dust is placed into supersacks which are then added to the EAF charge baskets with the stainless steel scrap. Each heat consists of two baskets; the first EAF basket contains scrap and quick lime, while the second EAF basket contains scrap and AOD dust.

Outcome

NAS has been able to reduce quantity of dolomitic lime purchased by 6,412 metric tons, and to reduce the quantity of hazardous waste that is landfilled by 10,238 metric tons for calendar year 2018.

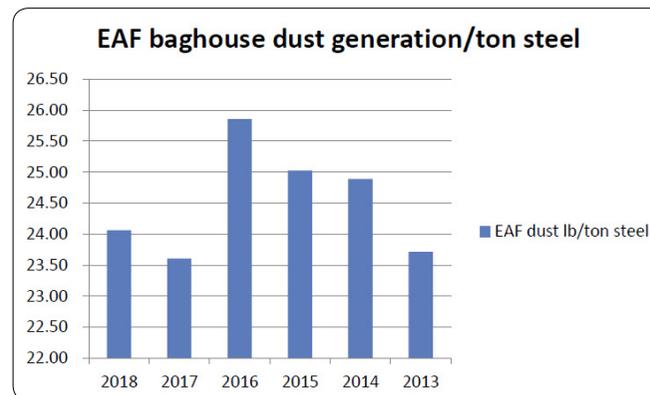
NAS evaluated the total quantity of dust that was being generated at the melt shop as well as the EAF baghouses to verify that the AOD dust that was placed in the EAF was not just passing through to the baghouses, but was producing slag.

During 2018, the quantity of dust generated at the melt shop would have been 44,478 metric tons if the dolomitic lime in the AOD did not react and directly

passed through to the baghouse. However, NAS produced only 34,240 metric tons of baghouse dust (the reduction of 10,238 metric tons).

The EAF baghouse dust generation rate was verified as well. The 2018 average dust generation rate was 24.06 lb/ton of steel which is consistent with the generation rates for year 2013-2017. The average historic generation rate is 24.62 lb/tons of steel. The average generation rates for 2013-2017 range from 23.61 to 25.86 lb/ton of steel produced.

NAS was able to save approximately \$1,000,000 by using the AOD dust as a source of dolomitic lime in the EAFs.





Acerinox

Award: Sustainability
Category: Value to the Customer

Green Value

Challenge

Acerinox would like to offer value to the society and is launching a project of an orchard managed by the retired workers of the mill.

Action

Acerinox has located a property and has designed the orchard area, the parking and equipment storage areas, and secured the electricity and water supply. Within the retired staff, Acerinox has contacted one of them belonging the Village of Palmones, where the orchard is to be located and close to the mill site. The project will be welcomed by the community.

Outcome

The project has brought retired workers back to the mill and they have an interest in developing this green value for the village and for the environment. Acerinox offers a tool that reduces the impact of the mill.

Nippon Yakin Kogyo

Award: Sustainability
Category: Energy Intensity

Implementation of energy-saving by IGBT element

Challenge

A Gate Turn-Off thyristor (GTO) element was used to drive a motor. However, there was a serious problem due to the loss of power.

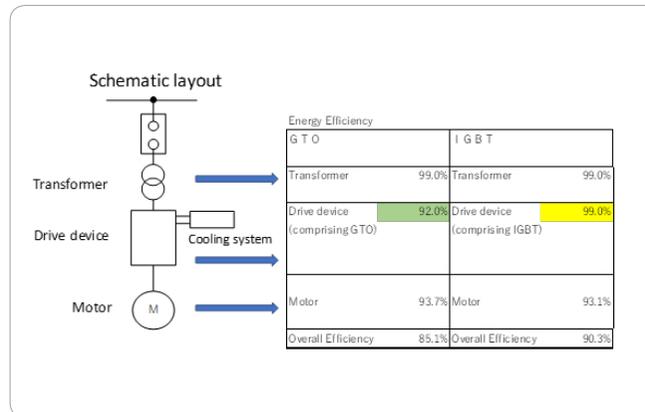
Motors (2 sets) Power Loss; 674kW
Converter (2 sets) Power Loss; 928kW
Transformer (2 sets) Power Loss; 144kW
Overall Loss; 1,746kW (Efficiency 85.1%)

Action

When considering the replacement of the device, we decided to replace it with one device using an Insulated Gate Bipolar Transistor (IGBT) element instead of a GTO element. After the replacement, the figures for the power loss are as follows.

Motors (2 sets) Power Loss; 742kW
Converter (2 sets) Power Loss; 220kW
Transformer (2 sets) Power Loss; 112kW
Overall Loss; 1,074kW (Efficiency 90.3%)

The energy efficiency was improved by 672kW.



GTO: (Gate Turn-Off thyristor)

A gate turn-off thyristor (GTO) is one of the special type of thyristor.

The GTO has a function that can turn off itself by passing a current in the reverse direction to the gate.

IGBT: (Insulated Gate Bipolar Transistor)

An insulated gate bipolar transistor (IGBT) comprises a field effect transistor.

The IGBT is applied for power control.

Outcome

By installing the new device comprising the IGBT

element, we achieved a reduction in the annual power consumption as follows.
Annual power Consumption
Previous device (GTO element); 5,478MWh
New device (IGBT element); 2,451MWh
Therefore, we can now save 3,027MWh of energy.



New device (IGTB element)



Columbus Stainless

Award: Sustainability
Category: Environmental Management System (EMS); Material Efficiency

Columbus Millscale Briquetting

Challenge

Oxide by-products arise from various processes in the manufacture of stainless steel. Handling and disposal occurs along two main collection routes, with dust from melting operations handled via a silo and all other scale and oxides centrally collected in a transfer store. In accordance with national environmental legislation and the GHS system of classification, many of these streams need to be disposed as hazardous waste in the absence of a recovery route. This has an environmental footprint impact in terms of volumes going to landfill, in addition to economic impacts flowing from disposal cost and loss of valuable elements.

Action

Several oxide recovery processes have been pursued in the past, with varying degrees of success, as indicated below:

- Collection of the coarse fraction of Steelplant dust in bulk bags and loading back into charge baskets as feed into the EAF (current practice that completely addresses that specific portion of dust).

- Co-feeding of oxide dust into a ferrochrome smelting process to deliver a nickel enriched ferrochrome product.
- Smelting of oxide dust and carbon reductant to deliver a dedicated alloy stream back to Columbus by an external contractor (established practice that ran for about three years, delivering a metallic product similar to the previous point, but was discontinued due to smelting cost negatively affected by low yield in the process that was used, and large capital investment required to improve the process).
- Blending oxide scale and dust on-site with other recovered material (grinding swarf) and loading directly into charge baskets (no processing cost but generates handling and spillage issues if done in significant volumes – currently done on small scale).
- Briquetting a mixture of Steelplant dust and reductant for loading into the EAF (fairly homogeneous product that is relatively easy to bind but never progressed past trial scale due to breakeven challenges as a result of low nickel content, and zinc accumulation if continuously recycled).
- Injection of various oxide dust products during

oxygen lance blowing in either EAF or Argon Oxygen Decarburisation (AOD) refining step (trialled on limited scale but requires large investment in handling equipment).

The aim of the current project was to recover a portion of the metals previously being disposed in oxide form, by agglomerating a blend of the mixed oxide and a silicon carbide reductant in briquette

form for loading into the Electric Arc Furnace (EAF) melting operation. The mixed oxide from the transfer store, consisting mainly of wet scale from the Central Water Treatment Plant (Figure 1), oxide dust from the Acid Regeneration Plant roasting process (Figure 2) and a blend of dry scale and spent iron shot from the Anneal and Pickle Lines shot blasters (Figure 3) was



Figure 1: Scale settling and collection

Columbus Stainless

Award: Sustainability
Category: Environmental Management System (EMS); Material Efficiency

Columbus Millscale Briquetting



Figure 2: Acid regeneration dust collection



Figure 3: Shot blaster dust collection

chosen for the project for two reasons:

- Compared to dust from the melting operation (commonly referred to as Steelplant dust), this waste stream contains a higher percentage of nickel, providing an inherently higher value for recovery.
- The Steelplant dust contains a significant portion of zinc oxides which, due to its volatile nature, would accumulate in the dust handling system if recycled back to the EAF in significant volumes.

From the outset of the project, the requirement was to find an agglomeration process that could

accommodate a blended product of the oxide wastes described earlier, as the handling route is set up for central collection (Figure 4) prior to recovery or disposal. After resolving a binder formulation that would be applicable for the range of chemistry, pH and oil content of the waste, compressive strength and water resistance of the briquettes were still insufficient for the proposed storage and feeding route. Further development of a force feeding arrangement into the briquetting rolls solved the density problem, and usable briquettes were obtained (Figure 5).

The potential for metal recovery was evaluated by loading plant scale trials of between 5 and 10 tons of briquettes per 100 ton heat and measuring the chemistry after tapping. Calculation of the exact yield per heat was hampered by variation in the

composition of raw materials loaded, but comparing the trial and control populations showed in excess of 90% of the nickel loaded as oxide, reporting to the stainless steel melt. Material for this trial was loaded into the charge baskets in bulk bags (Figures 6 through 8), although the briquettes can also be accommodated in the automated bulk feeding system of the plant.

Melting time and electrical energy input was monitored for the trial heats, in comparison to a control sample where no oxide briquettes were loaded. The reduction of the oxides in question is an endothermic process which, dependent on the type of reductant used, could add about 2 minutes of melting time and a 3% increase in electricity (and related electrode) consumption per 5 ton addition of oxide briquettes. When compared to a control



Figure 4: Transfer store



Figure 5: Briquette sample



Figure 6: Briquettes loading



Figure 7: Briquettes loading



Columbus Stainless

Award: Sustainability
Category: Environmental Management System (EMS); Material Efficiency

Columbus Millscale Briquetting



Figure 8: Briquettes loading

sample of the same steel grade, with similar additions of carbon and silicon reductant, the trial sample showed an average increase of 1.5 minutes in melting time. Even though the size of the sample did

not allow for a statistically significant difference to be measured between the samples, the magnitude of the impact agrees with the theoretical calculation based on reaction energy involved.

It is possible to eliminate the time penalty by using a higher proportion of silicon as reductant, in which case the cost of processing time must be balanced against the higher cost of silicon compared to carbon, in particular when scaling up to full production.

Outcome

The project has proved the viability of this recycling option, but will need to be scaled up before continuous benefits are realised. After accounting for the cost of transportation and briquetting, and additional electricity, electrode and flux requirements in the EAF, the material used for the trial showed the benefit of eliminating disposal cost and generating an additional saving of five times the disposal cost when considering the metal recovered.

When comparing this recovery route where reduction of the waste oxides is done in the EAF, to other options where the recovered material is already delivered in alloy form, the time penalty when using lower cost reductants must be considered. As mentioned above, a breakeven point exists in the balance of reductant cost and the cost associated with melting time. However, when the smelting is done by a third party in a separate process, consideration must be given to the additional slag and dust waste streams which require treatment or disposal, and the associated environmental and cost impacts.

Results up to this stage of the project show that it will be possible for Columbus to eliminate the

disposal of all its millscale and oxide dust wastes, and potentially a portion of the Steelplant dust. In addition, the recovery of metals can provide a benefit that far exceeds the disposal cost avoided.



Outokumpu

Award: Sustainability
Category: Emissions; Material Efficiency

Reduced paper consumption contributes to climate protection

Challenge

Cold rolled flat products are delivered in coils. An intermediate paper layer is used to protect the steel surface. The used paper comes from different machines and is not perfectly rolled. Normally these papers are just used and disposed of. Even when the paper is sent for recycling, the recycling process consumes energy and resources.

Action

Outokumpu has made efforts to save paper and to reuse it as much as possible. In 2018, a project at the cold rolling mill in Krefeld, Germany, succeeded in economical savings as well as in environmental protection. The used paper comes from different machines and is not perfectly rolled. It needs to be unwinded and properly rolled without bends and cracks to be re-used as intermediate paper layer in the process. Two additional optimization steps have been followed: if the paper cannot directly be re-used it can also be applied as oil absorbent paper and, in special cases, coils are rolled without intermediate paper layer. By focusing on these measures it has been possible to decrease the paper consumption in the Krefeld mill.

Outcome

The reduced paper consumption in the first implementation phase in Krefeld contributed to climate protection by yearly savings of about 1,200 tonnes of CO₂ emissions through avoided paper production. Saving in the water use was about 1,700 m³. Additionally, the optimization of paper use resulted in economic savings.



Coil with paper



Columbus Stainless

Award: Sustainability
Category: Environmental Management System; Material Efficiency; Investment in new processes and products

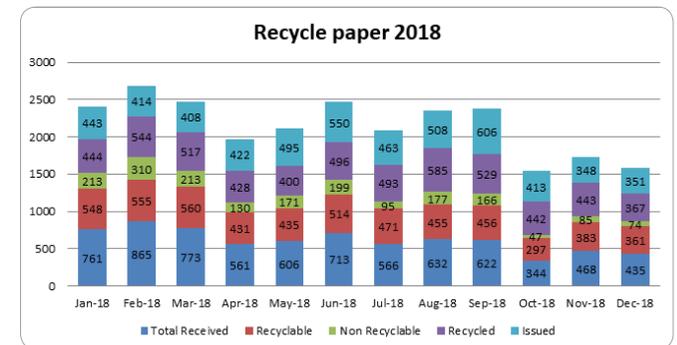
Paper Recycling

Challenge

Excessive amount of interleaving paper generated by the plant that ends up in land fill afterwards.

Action

Columbus uses a substantial amount of interleaving paper in the manufacturing of stainless steel to ensure quality standards are met. Instead of using new paper every time a coil is processed at the different manufacturing processes we identified plants that can utilise recycled paper as appose to new paper. This would then result in a direct cost saving and also reduce the volume of paper destined for land fill. Clean paper is recovered throughout the manufacturing process by means of paper rewinders



opportunities to increase the use of recycled paper even further.

Outcome

Annually, Columbus will recover 7346 rolls of paper from the manufacturing processes that would previously be disposed of in land fill. From this quantity a total of 5688 rolls (67%) is recovered and re-applied to the product. We only had to dispose around 33% of paper that was torn very bad and contaminated with oil.

already installed on the various equipment setups. The recovered paper is then rewound, joint and trimmed for re-use in downstream and upstream manufacturing processes. Paper that could not be recovered due to oil contamination is then disposed of by a Waste Management company. In 2018 Columbus invested further in their paper recycling capacity by purchasing a second paper rewinding machine that doubles the recycling capacity. We are currently investigating other application





Bahru Stainless Sdn. Bhd.

Award: Sustainability
Category: Material Efficiency

Metal Waste is NOT Waste

Challenge

Metal residue from stainless steel making process, contains Nickel, Chromium and Iron has become a waste handling issue. It is difficult to landfill for environmental reasons, and not desirable in terms of wasting metal. There are still very limited technologies available to recover the valuable metals from the stainless steel metal residue in Malaysia.

Action

Bahru had been working with a local waste recovery company to develop a reducing process to achieve a metal recovery opportunity from the Metal Oxide and Metal Scale Residue. This project not only assists to eliminate landfill by putting the priority of waste treatment to the potential metal recovery, but also contributes to the advancement of the local metal recovery process to advanced technology.

Outcome

Bahru Stainless's stainless steel making process generates tons of metal bearing waste. Local metal recovery industries in Malaysia are limited to the metal extraction and not able to recover the metal waste in oxide form. To eliminate landfill options, Bahru worked with a local waste recovery facility to initiate a potential reducing process for recovering metal oxide and metal scale residue. In 2018, a total of 1178 tons of recoverable alloy ingots were successfully produced and sent to the stainless steel manufacturer as secondary raw materials. The recovered alloys contain an average of 7.3% Nickel



Metal Oxide Dust generated by Acid Regeneration



Metal Scale generated from Scale Breaker



Furnace in Operation for Alloy Recovery



Recovered Alloy Casting Process



Recovered Alloy Ingot Final Product



Recovered Alloy Ingot in Shipment Container

Bahru Stainless Sdn. Bhd.

Award: Sustainability
Category: Material Efficiency

Metal Waste is NOT Waste

and 8.6% Chromium.

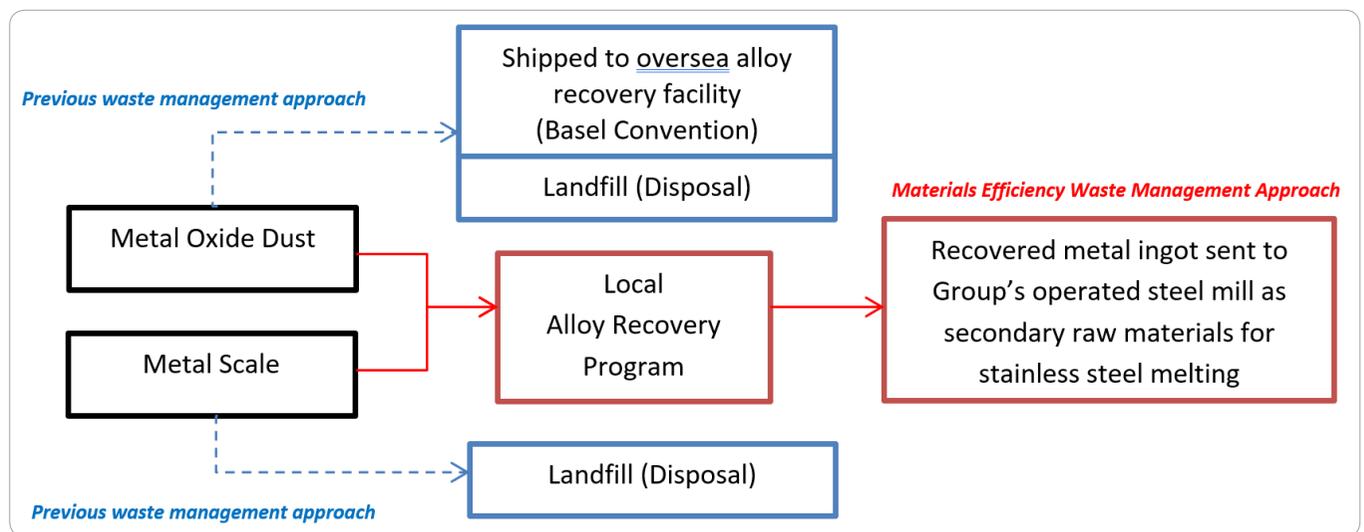
As societies move waste management practices up the hierarchy towards recovery, recycling and re-use, Bahru Stainless has played a role in motivating and assisting local waste facilities to be able to develop a new pathway towards an advanced technology level to achieve the potential metal recovery technology. Eliminating about 3,600 metric tons per annum of landfill not only brings a positive impact environmentally, Bahru Stainless has benefitted from avoiding the expensive landfill treatment fees and saved the precious metal from being treated as waste disposal as happened previously. It is estimated that Bahru will benefit from this initiative with about USD 400,000 savings per annum from metal recovery and landfill treatment avoidance charges.

The recoverable metal is treated as value added metal ingot and supply to the stainless steel process as secondary raw materials. This not only fulfills the commitment to keep Nickel within the stainless steel process life cycle, it also contributes to prevent and reduce excessive metal ore mining by natural resources conservation.

2018	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Alloys (ton)	100	--	87	91	125	--	225	100	125	100	125	100
Ni %	7.39	--	7.22	7.03	6.85	--	7.14	7.79	7.65	7.2	7.5	7.13
Cr %	8.55	--	8.32	8.15	9.31	--	6.97	8.57	9.15	8.71	9.13	8.7

Alloy Recovery Program Performance in 2018

Total 1178 tons of recovered alloy ingot is shipped to the sister company, Columbus Stainless, as the secondary raw materials for the stainless steel melting process. The recovered alloy ingots are in averaging of 7.3% of Nickel and 8.6% of Chromium.



Schematic Flow Chart of the Waste Management towards Materials Efficiency Approach



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Help page

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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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