



International Stainless Steel Forum 2014 Sustainability Award Case Studies

SUSTAINABLE
STAINLESS

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Welcome from the Chairman of the Health, Safety and Environment Committee



The stainless steel industry has been creating sustainable products for more than 100 years. In doing so, it is helping to build a better society for the future. For example, the production of renewable energy and clean water require stainless steels. They are critical for reducing the impact of energy production and industry on the environment.

We are also creating sustainability within our companies and among our customers and stakeholders. The case studies submitted by our members for our annual Sustainability Awards reveal many different success stories. They show how our members are continually seeking new ways to create added value for the environment, for their customers and for society in general.

But our members have also done very important work in improving safety in the workplace and improving the health and wellbeing of the people who work in our industry. The health and safety of our workforce is a constant priority for all our member companies and is a continuing priority for ISSF's Health, Safety and Environment (HSE) Committee.

This is the fourth consecutive year in which the ISSF has presented Awards for excellence in sustainability. This year two Awards will be made – one in the category 'People' and one for 'Planet and the Profit'. A total of 27 case studies have been submitted for this year's Awards, from 15 member companies. The standard of the entries has been increasing year-by-year and the judging process was particularly difficult this year as so many good entries were submitted.

The importance of sustainability and responsibility is increasing globally. The challenge our industry faces is how to turn our achievements in this area to our advantage by adding value for our customers and for end-users of stainless steel. The ISSF website is an important tool for sharing this knowhow and these good ideas and improvements. I highly recommend that you study this year's submissions, and re-visit the submissions from previous years. There are some very good solutions, practices and cases from which we can all learn and profit.

Dr Juha Ylimaunu

Chairman,
ISSF Health, Safety and Environment Committee

Secretary-General's Message



When our HSE Committee decided to introduce an award to reward excellence in the fields of human and industrial sustainability, the hope and expectation was that we would build a reference library of good practices which could easily be copied or followed by other members and lift the sustainability of our industry. To an extent, our aims have succeeded. In the four years since this Award was initiated, there have been a total of 105 submissions and the standard has steadily improved.

But what is worrying is that the number of member companies who are submitting entries has varied between 11 and 15 in each year. In most cases it is the same companies who have submitted entries year-after-year. We have a total of 61 members in ISSF, of which 36 are stainless steel producing companies. Many of those companies have multiple production sites and I am confident that most, if not all, are focusing strongly on improving the sustainability of their products and environments, and safeguarding their people.

We need our members to respond more regularly to our sustainability surveys. We need them to review their internal practices and submit their best case studies from which others may learn. I would hope that for our 2015 Award we can receive at least one submission from every member of the ISSF. Don't misunderstand me – we are not just looking for quantity. Our experience so far has been that there is a high level of quality among the

submissions we have received. It is logical to assume that there must be other high quality work in this field within our industry.

This year's submissions have been of a particularly high standard and this has made the task of our judges that much more difficult. The two Award winners are worthy recipients and are to be congratulated. But members are encouraged to read all of the other entries as well – they have all been published in our 2014 Sustainability Award brochure. It would be a good idea to re-visit previous brochures as well, because we now have a collection of 105 ideas to motivate you and your teams to seek further improvements.

I would like to say a special word of thanks to Weijie Yin, our HSE Fellow from Nippon Yakin Kogyo, who has been responsible for sending out the 2014 surveys and for studying the replies and managing the judging process. I would also like to thank Dr Ylimaunu and the ISSF Team who assisted Weijie Yin with his work. I would particularly thank Henk Reimink, Vanessa Riedemann and Clare Broadbent of World Steel for kindly agreeing to take on the responsibility of acting as independent judges for this competition.

Please work safely and help to safeguard our environment.

John Rowe
Secretary-General, International Stainless Steel Forum

Summary of Case Studies

All ISSF member companies were invited to submit entries for the 2014 Sustainability Award. Fifteen companies sent in 27 cases studies for consideration.

This year, two awards will be presented. The first is for initiatives that affect the health and safety of the people

who work in the stainless steel industry. The second recognises actions that have improved the profitability of a member company or have led to environmental improvements.

The following tables summarise the entries received.

Category: People

Company	Case Study	<i>Accident analysis</i>	<i>Safety training</i>	<i>Skill training</i>	<i>Workplace improvement</i>
Acerinox	Implementation of a new lift to handle plates				
Cogne Acciai	Foremen and supervisors focus of safety challenge				
JFE	Laser range-finder improves operator safety				
Jindal	Reducing lost time injuries with three-tier safety training				
Nippon Yakin	Introduction of a health and safety instructor system				
Outokumpu	Cancer risk study among stainless steel employees				
POSCO Specialty Steel	Improving the workplace				
SKS	Toolbox meetings enhance safety				
YUSCO	Investing in occupational health programmes				
	Training in AEO system to manage risk				

Category: Planet/Profit

Company	Case Study	Emissions	Environmental Management System	Energy intensity	Material efficiency	Investment in new processes and products	Value to the customer
Acerinox	Reuse of boiler overflow	■					
Aperam	New stainless steel acoustic barrier						■
Bollinghaus	Reducing noise emissions	■					
	Reducing emissions on the pickling line	■					
Columbus	Energy metering system identifies waste			■			
Jindal	Ensuring environmental compliance		■				
	Installation of an efficient emergency power system			■			
	Substituting nickel with nitrogen				■		
	Providing cost-efficient grades						■
Nippon Yakin	Promoting a low-carbon society with slag	■			■		
	Reducing energy costs by saving power	■		■			
Nisshin	Modified ferritic grades fulfil customer needs	■		■			■
NSSC	15-year plan results in 100% recycling of refractory waste	■					
POSCO	Improving yield with nitrogen steel stirring method				■		
YUSCO	Improving the deep drawing properties of grade 430					■	
	Reducing waste treatment costs with a cooperative approach				■		
	Tailoring stainless steel properties to customer needs						■

What Makes Stainless Steel a Sustainable Material?

Before we can determine whether stainless steel is a sustainable material, we should first define what we mean by sustainability in relation to what is known as the triple bottom line: People, Planet and Profit.

People

The material, in its use or in its production process, respects the human being, especially in terms of health and safety. A sustainable material does not harm the people working to produce it, or the people who handle it during its use, recycling and ultimate disposal.

Stainless steel is not harmful to people during either its production or use. A protective layer forms naturally on all stainless steels because of the inclusion of chromium. The passive layer protects the steel from corrosion – ensuring a long life. As long as the correct grade of stainless is selected for an application, the steel remains inert and harmless to the people who handle it and the environment.

These characteristics have made stainless steel the primary material in medical, food processing, household and catering applications.

Planet

The emission footprints of the material, especially those related to carbon, water and air, are minimised. Reuse and recyclability are at high levels. The material has low maintenance costs and a long life, both key indicators that the impact of the material on the planet is at the lowest levels possible.

The electric arc furnace (EAF), the main process used to make stainless steels, is extremely efficient. An EAF has a low impact on the environment in terms of both CO₂ and other emissions. The EAF is also extremely efficient at processing scrap stainless, ensuring that new stainless steel has an average recycled content of more than 60%.

Stainless steels are easily recycled to produce more stainless steels and this process can be carried on

indefinitely. It is estimated that about 80% of stainless steels are recycled at the end of their life. As stainless steel has a high intrinsic value, it is collected and recycled without any economic incentives from the public purse.

Profit

The industries producing the material show long-term sustainability and growth, provide excellent reliability and quality for their customers, and ensure a solid and reliable supply-chain to the end consumer.

Choosing stainless steel for an application ensures that it will have low maintenance costs, a long life and be easy to recycle at the end of that life. This makes stainless an economical choice in consumer durables (such as refrigerators and washing machines) and in capital goods applications (such as transportation, chemical and process applications).

Stainless steels also have better mechanical properties than most metals. Its fire and corrosion resistance make stainless a good choice in transportation, building or public works such as railways, subways, tunnels and bridges. These properties, together with stainless steels' mechanical behaviour, are of prime importance in these applications to ensure human beings are protected and maintenance costs are kept low.

Stainless also has an aesthetically pleasing appearance, making it the material of choice in demanding architectural and design projects.

Taking into account its recyclability, reuse, long life, low maintenance and product safety, the emissions from the production and use of stainless steels are minimal when compared to any other alternative material. A detailed and precise analysis of the sustainability of stainless steel makes the choice of stainless a logical one. This might explain why, as society and governments are becoming more conscious of environmental and economic factors, the growth in the use of stainless steel has been the highest of any material in the world.

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Category: People

Company	Case Study	Accident analysis	Safety training	Skill training	Workplace improvement
Acerinox	Implementation of a new lift to handle plates				■
Cogne Acciai	Foremen and supervisors focus of safety challenge		■		
JFE	Laser range-finder improves operator safety				■
Jindal	Reducing lost time injuries with three-tier safety training	■	■		
Nippon Yakin	Introduction of a health and safety instructor system		■		
Outokumpu	Cancer risk study among stainless steel employees				■
POSCO Specialty Steel	Improving the workplace				■
SKS	Toolbox meetings enhance safety	■			
YUSCO	Investing in occupational health programmes				■
	Training in AEO system to manage risk			■	



Acerinox S.A.

Implementation of a new lift to handle plates during packaging

Category: People
Sub-category: Workplace improvement

Challenge

During the packaging operations, workers stack the stainless steel plates in order to form the package. This operation is carried out with a lifting device that enables the worker to manipulate the plates. As the weight of each plate can be up to 1,800 kilograms, it is not an easy operation and injuries can occur.

It was difficult to use the lifting device to handle packages above 10 centimetres in height. Another disadvantage was that it could only stack sheets up to three-metres long. For longer plates the device had to be changed.



Action

The limitations of the plate lifting device became an issue for the Safety Committee. A new lifting system was assessed and approved.

The new system has a structure with two retractable wedges. The lifting operation is carried out with an overhead crane. Once the lifting device is placed on the plate, the operator only has to open the sides and lower the crane hook. When the hook goes up, the plates are trapped automatically.



Outcome

The new lifting crane facilitates plate stacking, and minimises manual handling and repetitive work. It has reduced the physical workload of the operators who carry out this job.

The lifting device reduces the time needed to stack the plates. It works with plates of all width and lengths.



Cogne Acciai Speciali Spa

Foremen and supervisors play key role in safety challenge

Category: People
Sub-category: Safety training

Challenge

Cogne Acciai Speciali (CAS) considers that the commitment of foremen and shift supervisors to safety plays a key role in ensuring a safe workplace. However, an assessment of 2012 safety data revealed that CAS personnel who have responsibility for enforcing strict health and safety regulations were the weakest links in the safety chain.

Supervisors at CAS are usually chosen according to their capacities as technicians. Their ability to manage a team and to promote good safety habits are rarely taken into account. The 2012 safety data revealed that supervisors themselves required further training so they could deal with their new responsibilities and act as real leaders in safety management.

Data from 2012 showed that 66% of all injury cases are work-related. Further analysis showed that behaviour was the largest single contributor to injuries, accounting for 42% of all incidents. Within this category, most injuries were caused by:

- Failure to use personal protective equipment
- Failure to respect procedures
- Incorrect use of machines, equipment or facilities
- Inexperience of the operator.

More than 80% of injuries affected new employees or staff that had recently changed functions within the company. During their trial periods, these employees are coached by the supervisor who may have little or no awareness of the importance of promoting safety behaviour. In many cases, the supervisors lack of vigilance or negligent attitude played a crucial role in the incident.

Cogne Acciai Speciali's safety campaign uses the slogan 'Lo Faresti?' - Would you do it?



Action

A new training programme for supervisors was developed. Supervisors were given a questionnaire to ascertain their safety awareness and weak spots before beginning the training. Two important questions were asked:

1. In 2012, 60% of injuries were caused by a lack of vigilance by the supervisor in charge. What is your reaction to this finding?
2. What do you expect from this course?

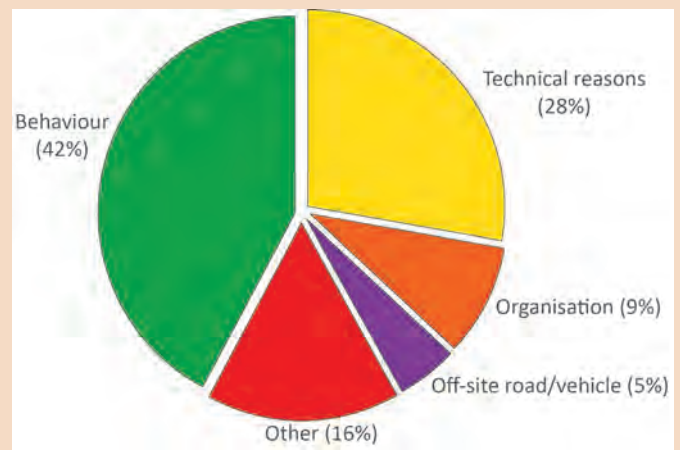
In response to the first question, 60% of the supervisors disagreed that the injuries were as a result of their own behaviour while the remainder admitted their failings.

The second question revealed that 67% of the supervisors thought they needed specific training on safety. Many feared possible criminal sanctions in the event of an incident.

In response, CAS developed a structured training programme which aimed to strengthen the strategic role and managerial skills of each supervisor. In collaboration with the University of Brescia, a training course for supervisors was launched in 2013. The training had the following goals:

- Instil in supervisors the effectiveness of creating a safety culture by developing good practices.

- Support the supervisor as the leader of safety improvements and the promoter of shared practices and safe behaviour in employees.
- Encourage the development of strategies and methods by actively involving the team.
- Enable supervisors to acquire the skills they need to inform, educate and train their employees.
- Create tools to constantly monitor activities and create an ongoing dialogue about experiences and skills.



Outcome

The training is being constructed around shared values which need to be constantly supported and encouraged. CAS believes this is a huge commitment and cannot be achieved in a short time.

Initially CAS did not expect to see noticeable results for about three years. However, this proved to be pessimistic as significant results have already been achieved in the first months since the training started.

For example, the injury frequency rate for the plant fell from 69.2 in 2010-2012 to 47.6 in 2013. In the period 2010-12 there was one incident for every 14,500 hours worked. In 2013 this fell to one injury per 21,000 hours worked.

	Injury frequency rate	Hours worked/injury
2010-12	69.2	14,500
2013-14	47.6	21,000

Part of the improvement is down to the active participation of supervisors themselves in injury prevention. In terms of activities under the sole responsibility of the supervisor, the following improvements have been noted:

- Among new employees and those changing function, the injury rate decreased from 81% in 2012 to 70% in 2013.
- Injuries related to a failure to use protective equipment decreased sharply from 12% in 2010-2012 to 6.6% in 2013.
- Injuries related to non-compliance with procedures and work instructions fell from 25% in 2010-2012 to 12.5% in 2013.

In a company where production activities are inherently dangerous such as CAS, the achievement of high health and safety standards is not impossible. However, it depends on economic investments to finance the modernisation of equipment, facilities and plants. It also requires a training strategy which develops a safety culture based on shared values among all employees at all levels of responsibility.



JFE

Laser range-finder improves operator safety

Category: People
Sub-category: Workplace improvement

Challenge

After the worker mounted a coil on the payoff reel of the slitting line, they had to manually adjust the coil according to the position of the blade. The adjustment enabled the slitting machine to cut the coil precisely. The operator had to manually measure the distance between the edge of the coil and the end of the reel which meant they were within the operating range of the machine and could be injured.



Action

A laser range-finder was installed on the slitting machine to measure the distance between the edge of the coil and the end of the reel. The operator can now adjust the position of the coil on the reel from outside the operating range of the machine. They only need to watch the measurements of the laser range-finder.



Outcome

Installation of the laser range-finder reduces the chance of the operator becoming caught in a coil as they can work outside the operating range of the machine.





Jindal Stainless Limited

Reducing lost time injuries with three-tier safety training system

Category: People
Sub-category: Accident analysis Safety training

Challenge

At Jindal Stainless Limited's (JSL) Hisar Unit we have experienced a relatively high rate of lost time injuries over the past few years. Accidents are always expensive for the individual and for the business.

At the individual level, the emotional and financial costs of an accident are very high. At the corporate level, accidents disrupt production, increasing costs and undermining the organisation's reputation.

Action

The best way to reduce accidents in the workplace is proactive prevention. As the saying goes: "An ounce of prevention is worth more than a pound of cure." Using a proactive approach, JSL has designed a Three-Tier Safety Training System to reduce the lost time injury rate. The system includes:

- Regular safety audits which are used to identify and analyse near-miss incidents, unsafe conditions, and unsafe work practices.
- Based on the findings of the safety audits, new safety training programmes are devised and delivered to all relevant personnel. The training establishes a uniform knowledge of safe work practices, safety values and safety standards across all personnel.
- Mock drills which are conducted on a regular basis in each section of the plant to check emergency preparedness. The findings of these drills are analysed and actions are implemented where necessary.

Outcome

By implementing our Three-tier Safety Training System we have reduced our lost time injury frequency rate from 0.68 to 0.25 within one year. We have started our journey towards achieving our goal of zero accidents.





Nippon Yakin Kogyo Co., Ltd.

Introduction of a health and safety instructor system

Category: People
Sub-category: Safety training

Challenge

At Nippon Yakin's Kawasaki plant we have implemented a Safety First action to reduce accidents and improve the health of our employees by keeping their minds and bodies in good condition. We have developed and implemented a systematic health and safety education programme.

Under Japanese law, the education of foremen is defined in Article 60 of the Industrial Safety and Health Act. However, Nippon Yakin is worried about the shortage of trainers and the content of the education programme which is becoming routine. We are also concerned that our health and safety system, where employees can easily consult and get advice from other colleagues, is insufficient.

We believe that foremen are the key to establishing safe workplaces and nurturing those people is the most important health and safety task for us.

Action

We have asked existing foremen to be lecturers and nurture trainees. By introducing the lecturer's own real-life experiences, trainees can learn in an interesting and practical way. Lecturers also become conscious of their responsibility and actively support Nippon Yakin's safety and health programme.

Our actions have included:

- Choosing a foreman from each workshop
- Supporting trainees to obtain the safety and health trainer licence
- Appointing lecturers and identifying them through distinctive badges (eight appointed in 2011, one in 2012, none in 2013, and three in 2014)
- Implementing foreman lectures and follow-up lectures (20 two hour lectures have been held every year since 2012)..

Outcome

Trainees receive their education (based on real experiences) from a trainer they know. As a result, employees understand the importance of the foreman in our health and safety activities.

Health and safety trainers also organised a 'trainers' club' to exchange information and ideas and improve their own knowledge twice a year. Through the trainers' club, we have raised the knowledge of health and safety across the entire plant and expanded the number of good case studies available to employees.

Outokumpu Oyj

Cancer risk study among stainless steel employees

Category: People
Sub-category: Workplace improvement

Challenge

Workers in the stainless steel industry are exposed to classified carcinogens such as hexavalent chromium, nickel compounds, asbestos, crystalline silica, polycyclic aromatic hydrocarbons and ionising radiation. These substances have been defined as carcinogens by the World Health Organisation's International Agency for Research on Cancer (IARC)

While stainless steel has been produced for more than 100 years, there are no published studies or data on the incidence of cancer in the industry's workers. Employees in the stainless steel industry have raised legitimate concerns about their potential increased risk of cancer caused by occupational exposure.

There have been suspicions about the increased risk of cancer among the general public living in the vicinity of a stainless steel production facility. Similar concerns have led to the partial closure of one carbon steel plant in Europe.

Action

Outokumpu agreed to carry out a study of the rate of cancer amongst workers in the Finnish stainless steel industry with the Finnish Cancer Registry (part of the Finnish National Institute for Health and Welfare).

The study group comprised people employed at the Kemi chromite mine and the Tornio ferrochrome and stainless steel mills during the period 1967 to 2004. The group was identified from the company's employment records. An extensive search of population registers traced the correct personal identity code (PIC), possible emigration date and vital status of all but nine (0.1%) 8,146 members of the group. The main group was divided into sub-groups according to their production departments.

Using the PIC as a key, the country-wide Finnish Cancer registry was searched. Cancer incidence rates among the general population of the same region were used as a comparison.

Detailed exposure data covering the whole production chain had been published earlier in peer-reviewed scientific publications.

Outcome

The results of the cancer study were good. The overall incidence of cancer among employees was similar to the general population in the same region. The risk of lung cancer risk was actually lower among the stainless steel industry employees.

An article 'Cancer incidence among Finnish ferrochromium and stainless steel production workers in 1967-2011' was published in the British Medical Journal in November 2013. A PDF of the article can be downloaded from the following link: <http://bmjopen.bmj.com/content/3/11/e003819.full.pdf+html>

The results of the study have been openly communicated to Outokumpu's own employees and to the general public through local and regional media. The information has been well received.

Because the results have been published in a peer-reviewed publication, they can be applied globally to any stainless steel production facility where occupational exposure is at similar levels.

The research project concluded that: "Occupational exposure in the modern stainless steel industry does not increase the risk of cancer among production workers."

POSCO Specialty Steel

Improving the workplace

Category: People
Sub-category: Workplace improvement

Challenge

We were trying to answer the following questions:

1. In order to make a better workplace, what changes are needed?
2. How can you positively affect the workers in a group?
3. Are there any financial or other systems the company can implement to achieve these goals?

Action

Interviews and research were carried out to determine the changes needed.

Outcome

With better workplace conditions, workers are more enthusiastic and work more efficiently.

Shanghai Krupp Stainless

Toolbox meetings enhance safety

Category: People
Sub-category: Safety training

Challenge

Safety awareness among employees is very important. We try to focus on it, strengthen it and improve it. But when safety meets production, it seems safety is not as important as production. Operators want to finish their production tasks and most of the time they are very busy. They do not have time to say 'Safety First'. Our challenge was to find a way to remind our employees that it should always be safety first. How could we get them to pay more attention to safety at the start of the day?

To answer these questions, we organised the Toolbox Meeting project.

Action

At SKS, the safety awareness of employees is raised through Toolbox Meetings – dedicated safety meetings at the beginning of each shift. The aim is to focus on work risks and remind employees of safety. We discuss a topic related to work risks and safety. At the end of the meeting we write down the topic and everyone signs. Our aim is to place a focus on safety at the start of every working day.

During the meeting we might discuss a safety incident that occurred in SKS or at other Outokumpu plants. The topic might also be a safety incident that took place in another company, another industry or society in general. The discussion may also be about Safety Operating Instructions which need to be studied or noted. The topics may also vary depending on the season. For example, in the summer the topic might be typhoon damage prevention.

The discussion itself is important. Raising relevant safety issues at the start of the shift helps employees keep safety fresh in their mind during the working day.

Every team leader checks the Toolbox Meeting books almost every day. If the safety meeting is not carried out properly, the team leaders will leave a message in the books. The Health, Safety and Environment Department also carries out periodic checks. The officer on duty will check whether the meetings have occurred during their weekly inspection. By constantly following up and reminding people about safety, we get everybody to participate.

Outcome

Since we've organised the Toolbox Meetings, employees know that the first thing they must do is to talk about safety. They review safety incidents which have occurred before, resulting in fewer incidents. When workers study their safety operation instructions again and again, the number of illegal operations is reduced. When we organise safety activities, the Toolbox Meetings provide a good forum to carry them out and record this has been done. We inform employees about the latest safety news, incident flashes and safety policy at the start of every day so that everyone on every shift focuses on safety.



Yieh United Steel Corporation (YUSCO)

Investing in occupational health programmes

Category: People
Sub-category: Workplace improvement

Challenge

Most of us spend nearly one-third of our day or more at work. Government policy encourages YUSCO to introduce health promotion activities which contribute to the physical and mental health of workers, and which improve workplace efficiency, reduce the rate of illness leave, and promote an excellent corporate image.

Action

The Ministry of Health and Welfare has promoted a 'Smoke-free Workplace' since 2003.

In 2007, the programme was expanded to include 'Healthy Workplace' and divided into three parts:

1. Tobacco Hazard Prevention
2. Healthy Start
3. Health Promotion.

In order to apply for the 'Health Promotion' recognition we had to comply with the Tobacco Hazards Prevention Act. We also had to be free from serious occupational accidents for three years.

YUSCO conducts health promotion activities according to World Health Organization (WHO) regulations for workplaces. Since 2005 we have regularly conducted tobacco hazard prevention and smoking cessation programmes. We conduct annual weight control classes, health promotion courses, and courses on how to control unhealthy behaviours. We also offer Chinese massage classes, workplace stress management classes, and other health promotion activities.

Outcome

For our approach to employee health, the Department of Health recognised YUSCO with two awards: Excellent Smoke-free Workplace and Smoke-free Workplace - Best Promoter.

We also applied to the Ministry of Health and Welfare for the 'Healthy Workplace' certification. We were recognised at the highest level and received the 'Health Promotion' acknowledgement in 2012.

Programme	Number of classes	Participants	Results
Weight loss	2	150	Participants lost a total of 151 kg in three months.
Quit smoking	1	19	Thirteen participants quit. After six months, eight are still not smoking.



Yieh United Steel Corporation (YUSCO)

Training in Authorised Economic Operator (AEO) system to manage risk

Category: People
Sub-category: Skill training

Challenge

YUSCO has developed a safety policy plan which has been communicated to all employees. We are also implementing an Authorised Economic Operator (AEO) identification system to ensure the safety of the supply chain and avoid the threat from unsafe activities.

Action

YUSCO is implementing the AEO system to ensure the safety of the company and its business partners.

This involves identifying and managing risks to the supply chain and adopting the appropriate risk assessment and management strategies to control those threats.

A series of training events have been held to increase the knowledge and skills of our staff. The training courses are divided into three categories:

1. Introduction to AEO, risk assessment and assessing internal risks.
2. Recognising internal risks to the business from suspicious freight or people. This component of the training also covers unusual stocking and shipping and alerting superiors to the problem.
3. Information security training shows employees how to keep information about YUSCO and its business partners safe.

By the end of 2013, we had trained 313 employees in the AEO system.

Outcome

The training courses help our employees to act responsibly. They not only understand the AEO regulations, but they also familiarise themselves with risk control and supply chain safety, and are equipped with the skills to reduce the possibility of risk.

The courses enable employees to identify problems and reach AEO standards in the areas of stocking, shipping, mail, freight, suspicious behaviour, and information security.

Our actions have made our supply chain system effective and secure. We plan to obtain AEO certification and establish an integrated crisis management mechanism in the future.

Section B: Planet/Profit Case Studies

Section B: Planet/Profit Case Studies

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Category: Planet/Profit

Company	Case Study	<i>Emissions</i>	<i>Environmental Management System</i>	<i>Energy intensity</i>	<i>Material efficiency</i>	<i>Investment in new processes and products</i>	<i>Value to the customer</i>
Acerinox	Reuse of boiler blowdown	■					
Aperam	New stainless steel acoustic barrier						■
Bollinghaus	Reducing noise emissions	■					
	Reducing emissions on the pickling line	■					
Columbus	Energy metering system identifies waste			■			
Jindal	Ensuring environmental compliance		■				
	Installation of an efficient emergency power system			■			
	Substituting nickel with nitrogen				■		
	Providing cost-efficient grades						■
Nippon Yakin	Promoting a low-carbon society with slag	■			■		
	Reducing energy costs by saving power	■		■			
Nisshin	Modified ferritic grades fulfil customer needs	■		■			■
NSSC	15-year plan results in 100% recycling of refractory waste	■					
POSCO	Improving yield with nitrogen steel stirring method				■		
YUSCO	Improving the deep drawing properties of grade 430					■	
	Reducing waste treatment costs with a cooperative approach				■		
	Tailoring stainless steel properties to customer needs						■



Acerinox S.A.

Reuse of boiler blowdown

Category: Planet/Profit

Sub-category: Emissions

Challenge

The boiler overflow at the site is connected to the sewage network. Acidity is normally alkaline, however, under certain conditions (for example, low flow rate) discharge quality may be affected.

The company follows an Environmental Improvement Plan and wants to avoid emitting low quality water.



Action

The Environmental Committee wanted to develop a solution to avoid low quality water being emitted from the plant. The Utilities section suggested connecting the boiler overflow pipe to the water treatment plant. In this way, alkaline overflow can be used to neutralise acidic water within the plant.

The Environmental Committee approved the proposal. A new Environmental Programme was opened in the Environmental Management System in accordance with ISO 14001.

Date of approval:	April 2013
Responsible departments:	Maintenance and Safety & Environment
Budget:	€10,000
Implementation date:	December 2013

Outcome

The boilers overflow was connected to the water treatment plant which has maintained the quality of the water emitted from our plant.

The solution has been quite simple to implement and very effective. The Environmental Management System has not registered any incident with water discharge. The site does not need as much lime due to the use of the alkaline wastewater.



Aperam

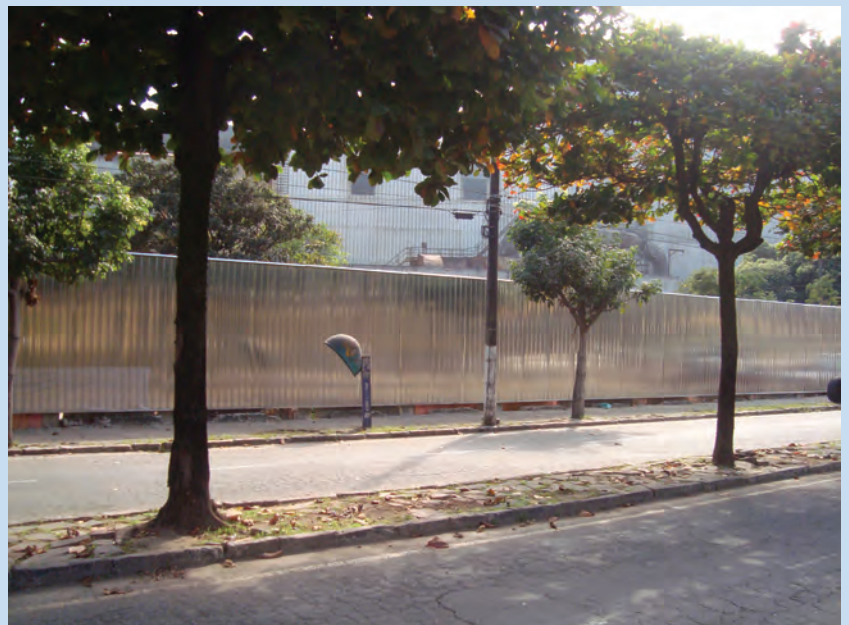
New stainless steel acoustic barrier

Category: Planet/Profit
Sub-category: Value to customers

Challenge

In the Aperam Timoteo (Brazil) melt shop there was a lot of noise generated by dedusting system fans, steel production, and scrap movement. The noise generated during the day was not critical. However, during the night it reached 67 to 70 decibels (dB). The legal limit is 60 dB. The plant received complaints from nearby neighbours.

This issue was identified as a major environmental problem by Aperam. We decided to search for a solution that would be efficient, but aesthetic and environmentally friendly at the same time.



Action

Following research, the options were:

- Stop the noise at source
- Work to reduce it considerably.

Efforts were made to reduce the noise at source but the results were not good and we could not reach the legal limit.

Engineers and environmental specialists analysed how we could reduce noise level outside the boundary of the plant. The final proposal was to build an acoustic barrier on the boundary.

The barrier is 300 metres long and 3.5 metres high. The original idea was to build the wall from concrete. However, the wall would have had low aesthetic appeal and would be subjected to graffiti. The environmental properties of concrete are also poor.

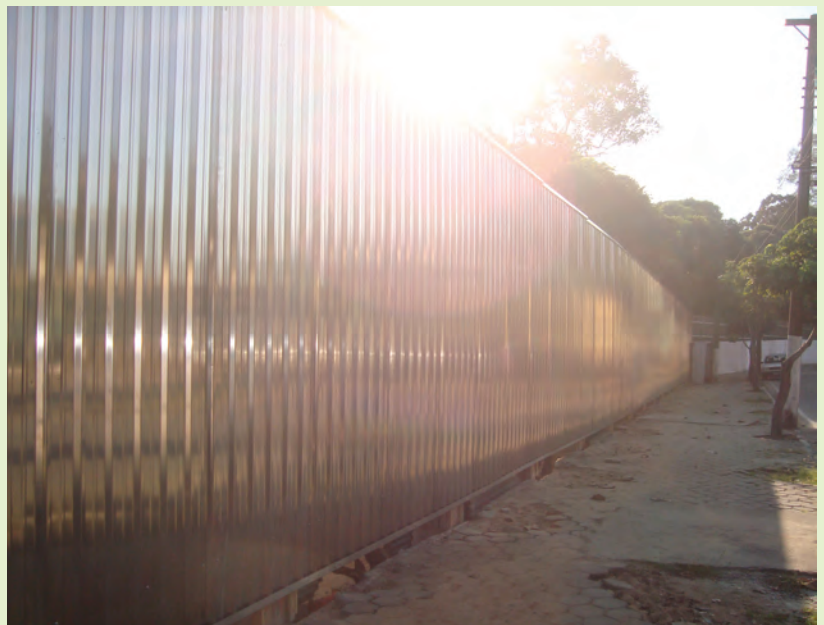
In order to meet our goals for an aesthetic and sustainable solution, stainless steel was selected. The barrier required 26 tonnes of stainless steel (20 tonnes of grade 444 and 6 tonnes of grade 304). Carbon steel (15 tonnes) was used for the structure and the interior was filled with a type of rock-wool to absorb noise.



Outcome

Since the project was implemented, noise outside the wall has reduced by between 7 and 10 dB. We have received complimentary letters from neighbourhood associations praising the project. Some of the benefits of this project are:

1. Outstanding noise reduction. We constantly monitor noise outside the boundaries of the plant. A 10 dB reduction in noise has been achieved.
2. We have had no more complaints from neighbours and we are complying with local laws.
3. We have a new, sustainable application for stainless steel in civil construction. Our barrier will have a long life, can be completely recycled, and costs nothing to maintain.
4. By using stainless steel we have chosen an environmentally friendly solution. The stainless steel barrier adds aesthetic value to the landscape in a way that no other material can do.





Bollinghaus

Reducing noise emissions

Category: Planet/Profit

Sub-category: Emissions

Challenge

Neighbours near the company's facility complained about high levels of noise emanating from the plant.

Action

A new soundproof gate was installed at the entrance to the plant and openings in the facade were covered with sound absorbing panels.

Outcome

Measurements were made with the soundproof gate open and closed. When closed, noise emissions were reduced by 11 decibels.



Bollinghaus

Reducing emissions on the pickling line

Category: Planet/Profit

Sub-category: Emissions

Challenge

As part of a review of local emission limits, the maximum level of inorganic fluorine compounds that could be released was reduced from 50 to 5 mg/Nm³. To comply with the new regulations, Bollinghaus Steel needed to reduce emissions of these pollutants by approximately 60%.

Action

Inorganic fluorine compounds are emitted in exhaust gases formed when chemical baths are heated on the pickling line for hot rolled bars. Bollinghaus carried out a feasibility study to determine whether installing a scrubber could reduce emissions of inorganic fluorine compounds enough to meet the new regulations. The study showed that emissions could be reduced by more than the 60% required.

Outcome

After installation of the scrubber, measurements showed that inorganic fluorine compound emissions had been reduced by a minimum of 91%. Installation of the scrubber has additional benefits:

- Gases can be reintroduced back into the pickling baths, reducing waste.
- Water consumption in the treatment process is negligible (less than one cubic metre per month).
- Reagent consumption is low (125 kg caustic soda/month to treat a flow of 5,000 m³/hour).



Columbus Stainless (Pty) Ltd

Energy metering system identifies waste

Category: Planet/Profit
Sub-category: Energy intensity

Challenge

Columbus Stainless operates the only stainless steel mill in Africa. It became necessary to measure the usage of electricity at individual plants within the mill. Because the steel moves through the mill in batches, each plant adds energy costs to the steel. The aim was to measure the energy use of individual. The biggest hurdles to implementing such a system are installing the necessary meters, capturing the data at a central point, and generating reports which can help manage each plant's energy usage.

Action

A centralised database was established and electricity meters were installed across the. Linking each meter with a fibre-optic cable would have been very expensive and time consuming. The solution was to install meters with built-in memory which capture and store the data. Each meter is linked to a mobile telephone modem. The modem transmits the data to the server via the regular mobile network.

Multiple meters can be linked to one modem to limit costs. The monthly costs are so low, fibre optic cable is no longer economically feasible. The built-in memory in the meters is particularly useful if the mobile network is out of order. Once the network comes back up, the meter sends the missing data to the server.

An Energy Management system runs on the server. The system stores the data, generates reports and trends, and can even send alerts if certain critical parameters are met or exceeded.

The system has been running for two years and has been expanded to capture water and gas usage data. Because the information network does not rely on cables, even the remotest electricity or water meter can be quickly connected to the database. This makes expansion of the system very fast and easy.

It is easy to make different calculations with the individual meter readings. We can report on the electricity, water and gas usage of plants, business units or products.

Outcome

The system has proven to be very powerful. Processes which used a lot of resources were quickly identified and immediate corrective action could be taken. Some processes which were never regarded as being energy intensive were identified and are now closely monitored. The system is also used to check utility bills. Some billing errors were identified and corrected.

Individual plant managers now use the system to meet energy usage targets and can react quickly as the data is available in real time. We can now benchmark the energy intensity of Columbus Stainless' processes against other steel producers. With continuous improvement it will be possible to reduce energy usage at the facility. It is also possible to audit the energy usage patterns of individual plants and identify opportunities for savings. Energy saving measures can be implemented and the savings are immediately measureable.



Jindal Stainless Limited

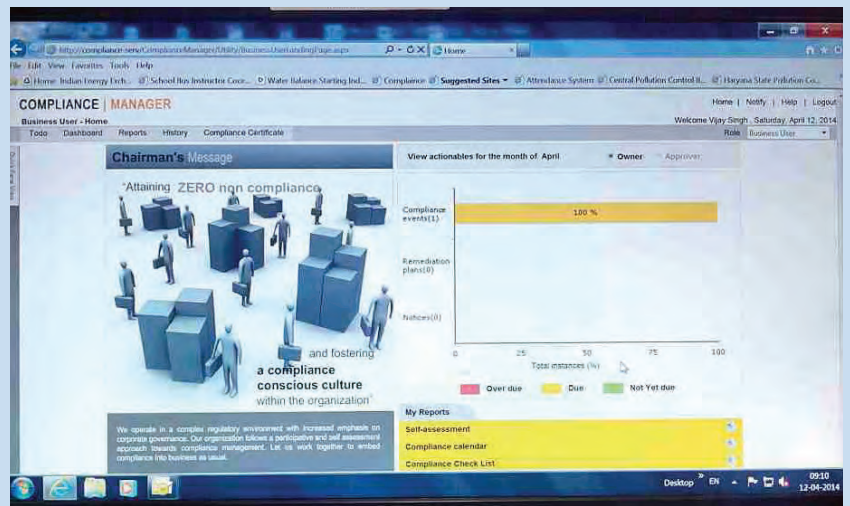
Ensuring environmental compliance

Category: Planet/Profit
Sub-category: Environmental management systems

Challenge

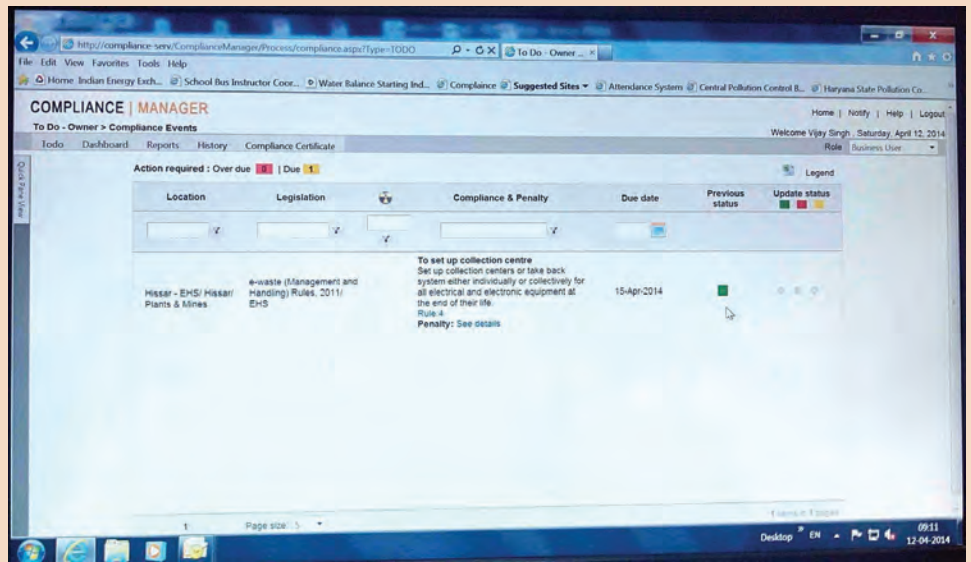
In general, compliance means conforming to a specification, policy, standard or law that is clearly defined. Regulatory compliance describes how corporations ensure that personnel are aware of, and take steps to comply with relevant laws and regulations and avoid penalties for non-compliance.

With more and more environmental regulations being issued, compliance management is an increasingly important part of day-to-day business practices. Bringing these diverse regulations into one integrated framework is a very important task, but a tedious one for any organisation's compliance team.



Action

JSL is one of the first stainless steel companies to have successfully and comprehensively implemented the Compliance Manager system. Compliance Manager enables JSL to effectively and responsively manage compliance with laws, regulations, standards and internal policies. The tool has enabled JSL to periodically review and report on compliance and identify non-compliance. Compliance Manager ensures we comply with all relevant standards and laws and avoid the risks associated with non-compliance.



Outcome

Compliance Manager uses legal and regulatory impact assessments in conjunction with policy management, surveys, assessments, and incident reports to facilitate compliance. An automated workflow ensures that we are always on the right side of the law. Implementation of Compliance Manager has enabled JSL to:

- React quickly to changes in laws, enforcement actions and external events
- Increase accountability and management visibility on compliance
- Reduce labour-intensive processes and documentation.
- Enforce standards and consistency throughout the organisation
- Streamline and direct internal audits into areas at high risk of non-compliance
- Support overall risk management and governance programmes with an integrated, quantifiable view of regulatory compliance.



Jindal Stainless Limited

Installation of an efficient emergency power system

Category: Planet/Profit
Sub-category: Energy intensity

Challenge

Emergency power is supplied to JSL by a six megawatt (MW) emergency power generator. When grid power fails, the generator is switched on. However, most of the time the generator runs at less than its full capacity – typically 2.5 to 3 MW. Operating the generator at less than peak capacity is not economically viable and increases air pollution.

Action

After studying the emergency generator's load pattern it was decided to install smaller capacity generators in each critical production centre, such as the casters and rolling mills.

We have installed small capacity emergency generators at each caster. Each generator can produce up to 750 kilovolt-amperes (KVA) of electricity. The generators sense when grid power fails and automatically start. Within eight seconds, power is supplied to the caster from the emergency generator. When grid power is restored, the generator automatically switches off. All operations are automatic, removing the need for manual intervention.

Outcome

Since the new generators have been installed there have been no blackouts at the caster and the equipment is running smoothly. The original 6 MW generator has been switched off. The following benefits have been achieved:

- Highly efficient operation of the generators
- Better process control due to the automatic operation of the generators
- Electricity consumption is reduced
- Emissions to the environment have been reduced.



Jindal Stainless Limited

Substituting nickel with nitrogen

Category: Planet/Profit
Sub-category: Material efficiency

Challenge

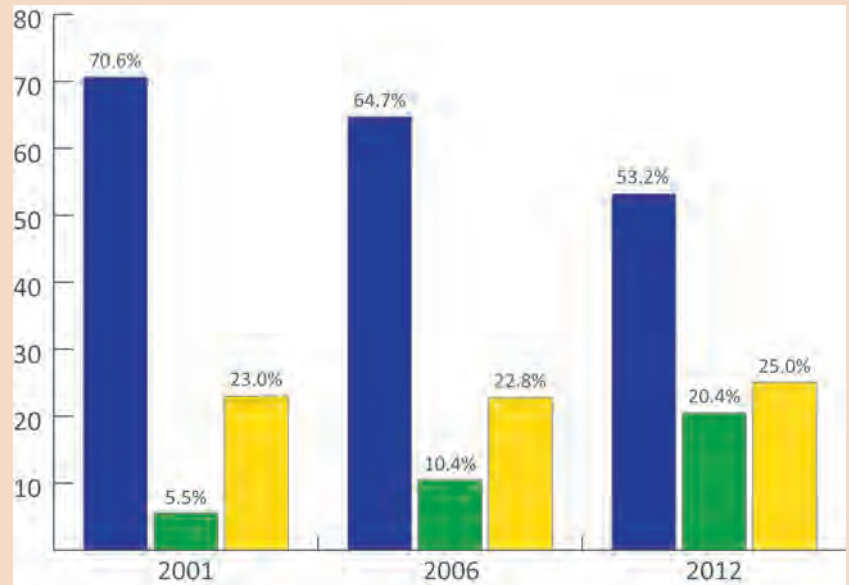
Nickel is mainly used in stainless steel as an austenite stabiliser and has a very limited role in improving corrosion resistance. Nickel is not an abundant material and this makes the element very expensive. At JSL we have focussed on producing high-quality stainless steels with lower nickel content such as chromium-manganese austenitic grades and low-nickel duplex stainless steels (see table).

Action

JSL currently produces around 350,000 tonnes of chromium-manganese (Cr-Mn) stainless steels containing up to 4% nickel. The grade can be used to replace 304 stainless steels which contain 8% nickel. The new Cr-Mn grades can be used in diverse applications such as catering and food processing, consumer products, architecture, building and construction.

Nitrogen can be used to replace nickel to improve austenite stability. The ratio is 0.05% nitrogen to 1% nickel. In a typical year we use around 35,000 tonnes of manganese and around 600 tonnes of nitrogen. Using nitrogen reduces our usage of nickel by 12,000 tonnes per year. As nitrogen is abundant in the air, it conserves a large amount of nickel which can be used for more critical applications in austenitic stainless steels and nickel-based alloys used in high temperature applications.

Comparison of chromium-nickel (Cr-Ni) austenitic, Cr-Mn austenitic and ferritic grades in global stainless steel production. Annual compound growth rate of Cr-Mn stainless steels is more than 19%/year which is steadily reducing dependence on Cr-Ni grades.



Outcome

Replacing costly Cr-Ni austenitic stainless steels with more affordable Cr-Mn grades has seen production of the more economical grades increase at nearly 19% per year since 2001.

It has helped to reduce nickel prices while promoting rapid growth of the stainless steel industry in recent years.

Details of the chromium-manganese grades produced by JSL

Characteristics	Grade	C	Mn	Cr	Ni	Mo	N	Cu
	AISI 201 (UNS S20100)	≤0.15	5.50-7.50	16.0-18.0	3.50-5.50	-	≤0.25	-
	AISI 202 (UNS S20200)	≤0.15	7.5-10.0	17.0-19.0	4.0-6.0	-	≤0.25	-
Copper bearing low work hardening	J1 (JSLAUS)	≤0.08	6.0-8.0	16.0-18.0	4.0-6.0	-	≤0.10	1.5-2.0
	J4	≤0.10	8.5-10.0	15.0-17.0	1.0-2.0	-	≤0.2	1.5-2.0
	J204 Cu (UNS S 20430)	≤0.10	6.5-9.0	16.0-17.5	1.5-3.5	-	≤0.2	2.0-4.0
	JSLU-DD	≤0.12	9.5-10.5	15.0-16.0	0.5-0.6	-	≤0.20	1.8-2.2
Lower carbon for IGC resistance	201LN (UNS S20153)	≤0.03	6.4-7.5	16.0-17.5	4.0-5.0	-	0.1-0.25	≤1.0
Highly corrosion resistant	J204 (DIN 1.4376)	≤0.10	5.0-8.0	17.5-18.5	3.5-4.5	-	≤0.25	-
	J216L	≤0.03	6.0-8.0	16.0-18.0	6.0-8.0	1.5-2.0	0.15-0.25	1.5-2.0
High strength non-magnetic	X8CrMnN18 18	0.05-0.1	17.5-20.0	17.5-20.0	-	-	0.5-0.7	-
Nickel-Free biocompatible	UNS 29108, Biodur 108	≤0.08	21.0-24.0	19.0-23.0	≤0.1	0.5-1.5	0.90min	-
Lean duplex	UNS S32101	≤0.04	4.0-6.0	21.0-22.0	1.35-1.70	0.1-0.80	0.20-0.25	0.10-0.80



Jindal Stainless Limited

Providing cost-efficient grades

Category: Planet/Profit
Sub-category: Value to the customer

Challenge

Traditional austenitic steels (300 series) contain a high percentage of nickel. The grades generally include a minimum of 8% nickel (grade 304) which increases for higher austenitic grades.

With just 8% nickel, the cost of the nickel alone accounts for 52% of the total cost of the alloy. Nickel prices are also volatile which leads to corresponding volatility in the prices these grades, causing customer concern. Our goal was to find cost-effective alternatives for grade 304.

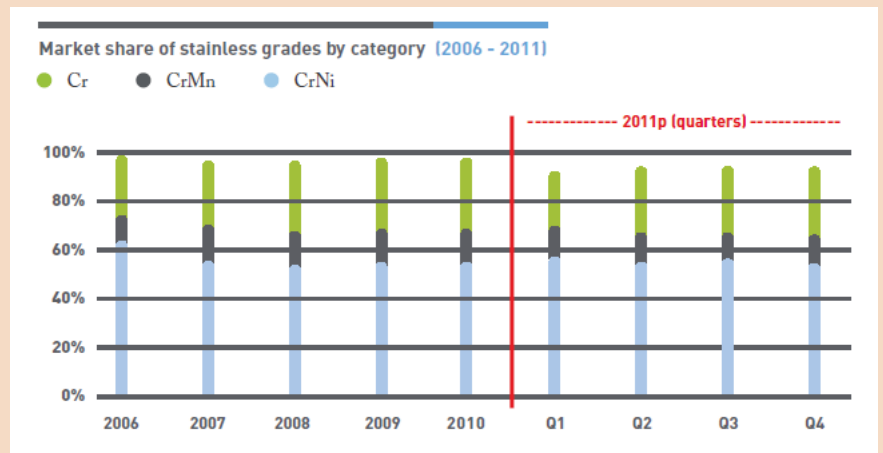
Detailed corrosion studies have proved that certain applications (such as white goods, utensils and household appliances) do not require high nickel content in the alloy. Even alloys containing just 4% nickel (and lower) can provide the required corrosion resistance.

Action

We chose JSL AUS (4% nickel) as a replacement for grade 304 in applications where corrosion resistance is not a major concern. Our selection was based on detailed R&D and evaluations by JSL. It was found that the right balance of austenite stabilisers (such as nitrogen, manganese and copper) will provide corrosion resistance equivalent to grade 304.

Increasing nitrogen content also improved strength, leading to higher yield strengths and improved abrasion resistance. We decided to develop a new grade (named JSL AUS) which replaces half of the nickel in grade 304 with nitrogen and manganese.

The main challenge to producing JSL AUS was the stabilisation of the argon-oxygen decarburization (AOD) process. Recovery of manganese and the silicon consumption rate were the main problems to be solved. After extensive research, testing and field trials, JSL successfully developed and established JSL AUS in the market. There are a host of new applications for the grade which simultaneously provides additional value to customers and the wider stainless steel world.



Outcome

The impact of nickel volatility on the market for stainless steel has been restricted and prices for the element have decreased. Reducing the amount of nickel from 8 to 4% has reduced the impact of nickel price volatility for our customers. The new JSL AUS grade is approximately 25 to 30% cheaper than grade 304.

The new grade also conserves nickel which is in short supply. Each tonne of JSL AUS reduces our nickel usage by 40 kilograms, a significant saving.

The new grade has inspired the development of a variety of Cr-Mn grades, which will continue to reduce price volatility and save more natural resources. The market share of Cr-Mn grades has escalated as a result.



Nippon Yakin Kogyo Co., Ltd.

Promoting a low-carbon society with slag

Category: Planet/Profit

Sub-category: Emissions

Material efficiency

Challenge

Limestone is typically mined in mountainous regions and used in various applications such as bitumen mixtures for paving roads. Transporting limestone from distant mountains wastes a lot of energy and produces mining- and transport-related carbon dioxide emissions.

In order to reduce the waste of energy and CO₂ emissions, Nippon Yakin tried to find a solution.

Slag, a by-product of stainless steel making, already has applications in landfill, however, there is little space left in Japan for landfill. Estimates indicate that landfill sites will only be viable for another 13.6 years. In areas such as Tokyo, landfill will only be viable for another four years.

In order to continue to produce stainless steel, Nippon Yakin must find alternative uses for our slag.

Action

With our Kawasaki plant located in the Tokyo area, we can stably and continuously supply slag. The plant has developed Nas Filler which is used to replace the limestone in bitumen. Sales of this product have already begun.

Outcome

By developing Nas Filler, CO₂ emissions from limestone mining and transport are reduced significantly. In the region where the Kawasaki plant is located, CO₂ emissions have been reduced by 70%. In addition, the slag no longer needs to go to landfill.

Nas Filler has been recognised as a product which contributes to the development of a low-carbon society. It has been awarded the 'Low CO₂ Kawasaki Brand' by Kawasaki City which is aiming to harmonise ecology and business. The Brand is only awarded to products or services which are developed in Kawasaki City and which contribute to the reduction of CO₂.

Signed by the mayor of Kawasaki City on 14 February 2013, this document authorises the production of Nas Filler and recognises the contribution it makes to the reduction of CO₂.





Nippon Yakin Kogyo Co., Ltd.

Reducing energy costs by saving power

Category: Planet/Profit
Sub-category: Emissions Energy intensity

Challenge

Nippon Yakin's Kawasaki plant produces stainless steel using an electric arc furnace (EAF). As a result, our energy costs are very high. Since the 2011 earthquake which damaged Japan's nuclear power capacity, electricity costs have continued to rise. Fuel costs are also increasing. Reducing our energy costs is one of the most important challenges facing Nippon Yakin.

Action

Since 2012, Kawasaki plant has adopted efficient LED lamps and replaced older electric machinery which wasted a lot of energy. An energy saving project has been implemented across all divisions of the business. Many ideas have been proposed as part of the project and some have already been adopted (for example, a review of the operating method of fans and pumps).

Outcome

Since implementing our energy saving project, the following benefits have been realised:

- Energy savings of 6,800 megawatt hours/year were achieved in 2013, equal to around 1.8% of the Kawasaki plant's total electricity consumption (enough to power 1,900 households).
- CO₂ emissions have been reduced by 696 tonnes/year, equal to around 1% of the Kawasaki plant's total CO₂ emissions. That equates to planting 715 hectares of forest.

Nisshin Steel Co., Ltd

Modified ferritic grades fulfil customer needs

Category: Planet/Profit
Sub-category: Emissions Energy intensity Value to the customer

Challenge

Due to tighter regulations concerning exhaust gases and fuel consumption, an increased number of vehicles are being fitted with an exhaust gas recirculation (EGR) cooler. By lowering the temperature of the exhaust gas, the cooler enhances the car's EGR system which improves fuel economy.

One of our customers needed a material with low thermal expansion and high strength at elevated temperatures (500 to 700°C) to manufacture a new EGR cooler.

Example of an EGR cooler



Action

In a conventional EGR cooler, austenitic stainless steels are commonly used. After discussions with the customer about their needs, we offered our proprietary ferritic grades (NSSEM-2:18Cr-2Mo-1Mn-0.4Nb and NSS442M3:19Cr-0.5Cu-0.5Nb). Both offer low thermal expansion and perform better than conventional austenitic grades.

Outcome

Using our high strength proprietary ferritic grades in the EGR cooler decreases production costs. The cooler lowers the temperature of the exhaust gas which reduces NOx emissions and improves the fuel economy of the car.



Nippon Steel & Sumikin Stainless Steel Corporation (NSSC)

15-year plan results in 100% recycling of refractory waste

Category: Planet/Profit

Sub-category: Emissions

Challenge

Over the past 15 years, NSSC has made significant efforts to reuse waste substances generated in the course of manufacturing stainless steel. Our aim is to conserve the environment and effectively use natural resources. We have introduced new processes to recycle spent refractory waste which is generated in the steelmaking and rolling processes.

In 1998, before we started our recycling activities, the Hikari Works generated approximately 4,900 tonnes of spent refractory material per year. Of that, 300 tonnes (6%) was reused. However, the remaining 4,600 tonnes (94%) were sent to landfill as waste.

NSSC determined that we would need to work on recycling refractory waste on a long-term basis. We planned to improve the recycling rate step-by-step, investing in equipment in a planned way. We established a plan for recycling refractory waste in 1998 and started allocating budget to the project in 1999. Our goal was to achieve a recycling rate of 97% or higher by 2010.

The table on the right shows how we recycle refractory and other waste.

We invested in equipment in three steps. The first recycling equipment was installed in 2001. It was further enhanced in two steps during 2003 and 2009. We set target recycling rates as milestones.

In 2001 we started collecting regular-sized refractory bricks. Since 2010 we have promoted the comprehensive recycling of refractory material. We now collect and recycle waste metals from refractory material and collect refractory material which is coated in molten steel splashes.

	Type of waste	Refractory raw material	Slag-making material	Sand (source)	Iron (source)
Refractory waste	MgO-Cr ₂ O ₃	X			
	MgO		X		
	Al ₂ O ₃	X	X	X	
	Al ₂ O ₃ -C	X	X		
Other waste	Slag			X	
	Dust powder		X		
	Splash				X
	Adhered metals/ironware				X

Action

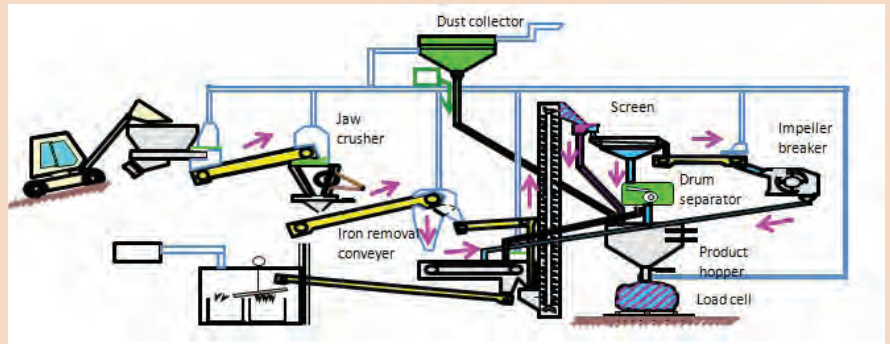
Spent refractory material is collected and separated at the refractory repair site. The recycling equipment crushes the material into predetermined grain sizes ranging from 6 to 100 mm. The recycled material is used as refractory raw materials, auxiliary raw materials for steelmaking, and as a source of iron and sand.

The following list shows the materials recovered and the type of refractory from which they are recovered:

- MgO-Cr₂O₃ (30% of the waste): EAF, AOD and ladles.
- MgO (37%): tundish boards.
- AL₂O₃ (26%): furnaces and other applications.
- AL₂O₃-C (7%): nozzles for sliding and submerged entry.

Collected metals are used as a source of scrap iron for the electric arc furnace (EAF).

The recycling equipment has two crushing lines which makes it possible to process all spent refractory waste



generated in the ironworks. The equipment features:

- High local ventilation and dust collection to reduce dust generation during crushing and pulverisation.
- Built-in magnetic iron removal conveyer. A drum separator on the crushing line improves the quality of crushed and pulverised materials.
- Ability to crush material of any shape including large or long lumps. Metal cases can be separated into metals and refractory material on the line.
- An automatic bagging machine to maximise productivity and ensure operator safety.

Outcome

We have been working to collect metals such as ironware and refractory material splashed with molten iron since 2010 (Step 3). The evolution of our recycling of refractory material is shown in the graph (right). The main steps have been:

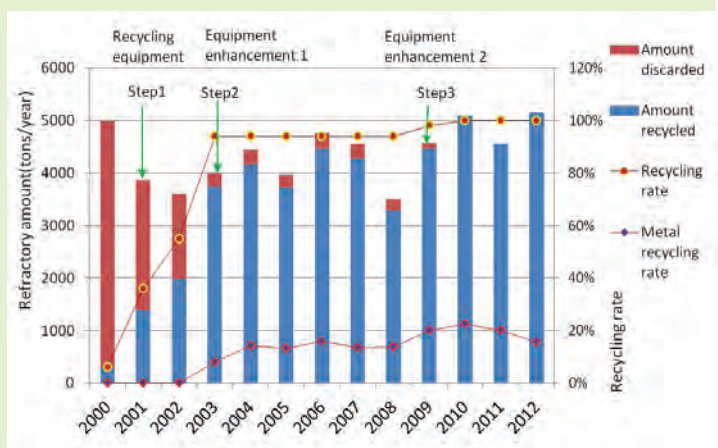
1. Recycling equipment installed (2001) and brick waste (MgO-Cr₂O₃) began to be recycled. A recycling rate of approximately 50% was achieved.
2. The recycling equipment was enhanced (2003) and the number of substances recycled was increased. The recycling rate reached approximately 94%.
3. A further enhancement of the recycling equipment was carried out (2009) so that the number of substances to be recycled could be extended to include other waste. Our recycling rate has been 100% since 2010.

As a result of the recycling, approximately 5,000 tonnes/year of spent refractory material is collected and reused. Previously this material was discarded. All refractory material generated in the steelmaking and rolling processes can be recycled.

Approximately 1,000 tonnes of metal is also collected

each year. Previously this was discarded with refractory material. The metal is used as raw material for the EAF.

NSSC's corporate philosophy is to manufacture stainless steel while preserving the environment and using natural resources in an effective way. In this way we contribute to society. As part this duty, we have steadily developed our ability to recycle spent refractory waste over the past 15 years. Now we have achieved our goal, we will set a new one and continue our work towards making the stainless steel industry even more environmentally friendly.



The graph above shows our activity since 2000.



POSCO

Improving yield with nitrogen steel stirring method

Category: Planet/Profit
Sub-category: Material efficiency

Challenge

There are three electric arc furnaces (EAF) at POSCO and we have developed various methods to improve their yield. However, when we compared the metal yield of the furnaces, the yield of #1 EAF was lower while the amount of Cr_2O_3 in the slag was. We found that the reason for the discrepancy is that #1 EAF does not have a bottom bubbling system which results in a different stirring action compared to the other EAFs.

During the melting process in #1 EAF, an oxygen lance is used to stir the molten metal. The oxygen, which is blown into the molten steel, oxidises the metal and lowers the yield of the EAF. To improve metal yield, a new stirring method was needed to enhance the reaction at the interface between the molten steel and slag without oxidising the metal.

Action

We chose to use nitrogen instead of oxygen as a stirring gas. At first, we blew nitrogen into the molten metal through the oxygen lance. However, this was a complicated and dangerous task so we needed a new method.

We converted an unused carbon injection lance into a nitrogen blower. The newly installed nitrogen line is linked to the carbon injection lance. The existing system can easily control the blowing time, lance position and the gas flow.

Outcome

Blowing nitrogen into #1 EAF has decreased the oxidation of molten metal and increased the stirring power. The change has enhanced the metal/slag reaction and increased the metal yield of #1 EAF. The yield index of 300 series has increased by 0.4% while 400 series has increased by 1.2%. In addition, the amount of slag has been reduced as a result.

	Metal yield	Cr ₂ O ₃ in slag
300 series	+0.4%	-24.7%
400 series	+1.2%	-15.3%



Yieh United Steel Corporation (YUSCO)

Improving the deep drawing properties of grade 430

Category: Planet/Profit
Sub-category: Investment in new processes and products

Challenge

Our popular stainless steel grade 430 with a 2B surface finish was exhibiting edge-stretch during the deep drawing process. This had a detrimental effect on material utilisation. Overcoming the problem was a primary concern for YUSCO.

Action

After studying the edge-stretch problem, we concluded that the problem could be fixed by adjusting the chemistry of grade 430. Content of the alloy were changed to improve the phase ratio during steel formation. Adjusting the contents and temperature has improved the edge-stretch properties of this grade and increased the material utilisation rate.

Outcome

Grade 430 is one of YUSCO's main products. Because of our actions we can look forward to remaining the market leader in our markets. Our customers also benefit through the improvement in the material utility rate. Both YUSCO and our customers can reduce their costs providing a win-win situation.



Yieh United Steel Corporation (YUSCO)

Reducing waste treatment costs with a cooperative approach

Category: Planet/Profit
Sub-category: Material efficiency

Challenge

Waste from stainless steel production must be treated well. It can become a pollutant, but it also contains a lot of metals which can be recovered and reused to make stainless steel.

At YUSCO, waste such as flue gas dust, sludge and metal waste are processed in our Resource Treatment Plant (RTP).

Waste treatment is also important to the nearby Tang Eng Iron Works. Tang Eng does not have its own RTP and pays high costs to third-parties who treat their waste. The situation is the same for other stainless steel companies.

We recycle our own waste and that of Tang Eng. We believe we can help Tang Eng and other companies to recycle their waste.

Action

YUSCO cooperated with Tang Eng to start a recycling waste project in August 2012. Permission for the project was given by the government on 23 January 2013.

Government permission allows us to transport waste from other steel companies to YUSCO and treat it in our RTP. This includes hazardous dust collected from the steelmaking process.

Outcome

Through cooperation, all of us benefit.

YUSCO's RTP treated 4,000 tonnes of waste from Tang Eng and produced more than 1,800 tonnes of metal ingots between January and November 2013.

In the same period, 500 tonnes of waste collected from downstream stainless steel companies were treated in YUSCO's RTP. This yielded approximately 230 tonnes of ingot.

The cooperation of all the companies involved helps us to reduce the cost of waste treatment.



Yieh United Steel Corporation (YUSCO)

Tailoring stainless steel properties to customer needs

Category: Planet/Profit
Sub-category: Value to the customer

Challenge

For customers, stainless steel prices can appear to be unstable due to the impact of raw material costs. From the time of ordering through to delivery of stainless steel products, prices can change dramatically due to high fluctuations in raw material costs. However, end users do not allow the prices they pay to vary. As a result, downstream customers look to their stainless steel producer for solutions to this problem.

Production costs can be lowered if a stainless steel company can find a cost-effective stainless steel grade which has a relatively stable alloy composition. They must also work with customers to alter the grade, or change production procedures to increase the customer's yield. Both measures can successfully lower production costs for both the customer and the stainless steel producer.

Action

A customer was using stainless steel grade in AISI 304, which has deep drawing qualities, to produce champagne barrels and shakers. However, the price of 300-series products is too high and relatively unstable. Two solutions were offered:

- Change of stainless steel grade.

We introduced the customer to grade ASTM S43932 which has suitable properties but a more stable cost. Our customer successfully changed to the new grade to produce their end products while still satisfying their customers.

- Change in production procedures.

By modifying production procedures or slightly adjusting the chemical composition of a grade, an increase in product yield can be achieved. In turn this lowers production costs. By increasing the elongation properties of a stainless steel grade, downstream producers can reduce the failure rate of the deep drawing process, thereby increasing the yield.

Outcome

The customer has used the new ASTM S43932 stainless steel grade to effectively solve the problem of price volatility. For YUSCO it has improved our profitability as we do not need to worry so much about the price volatility of nickel-based stainless steels.

Changes in YUSCO's production procedures provide customised stainless steel grades. It allows the customer achieve comparable yields to those obtained with AISI 304.

These actions enable both customers and YUSCO to create a win-win situation in the extremely competitive stainless steel industry.



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