



Stainless Steel & Welding Exposure Scenario for Nickel Occupational Exposure

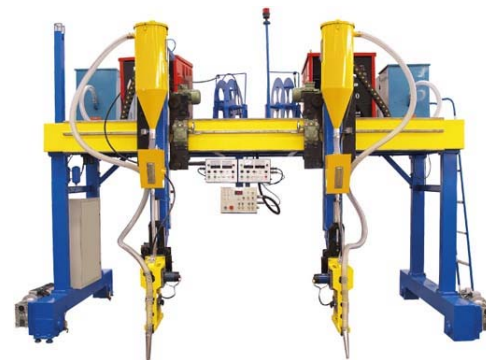
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Background

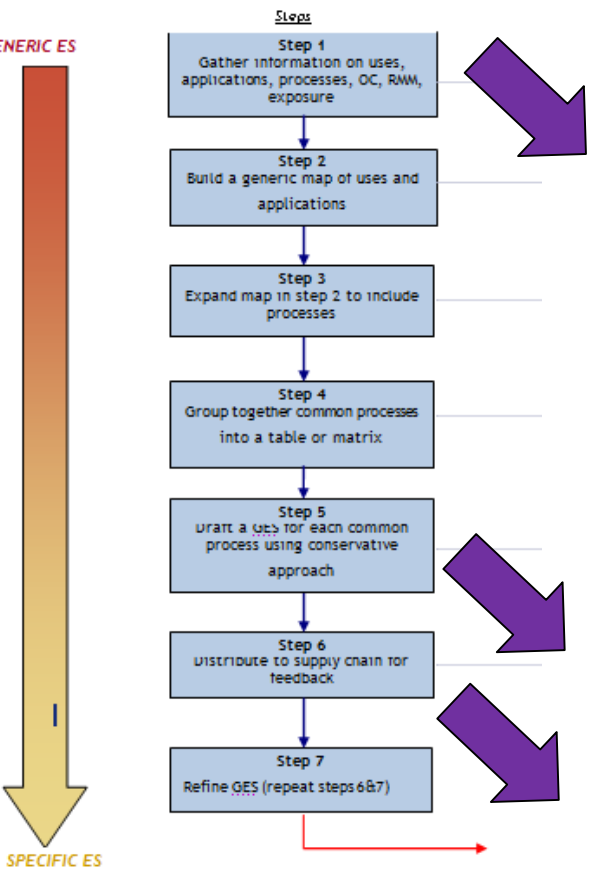


- EU welding consumables market is highly mature: market earned revenues of **USD1,162.7 million in 2007** and will reach **USD1,464.2 million in 2014**
- Increasing awareness of the improved productivity, higher metal deposition rates and reduced fumes offered by wired consumables
- Booming **construction industry** across EU and **establishment of industrial** bases in Eastern EU, together with the **restoration of old monuments** in Western EU, will support continued demand for welding consumables

Background

- *During welding, hazardous substances always occur in the form of mixtures, and consequently the determination of the limit values is complex*
- Maybe the REACH procedure could tackle the issue efficiently ?
 - **Exposure Scenarios:** Provide RMMs and identification of OCs under which the substances and preparations may be safely welded
- **Proposal:** gather existing information on welding processes, RMMs and OCs, as well as on existing OELs (for welding fumes as such or key components)
- **Objective:** provide the most appropriate RMMs guidance to meet, at least, the REACH requirements

Milestones



PROPOSED STEPS to Follow

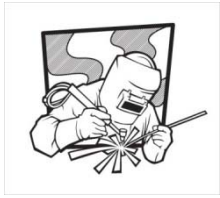
- STEP 1: gather existing information on the welding process for stainless steel and Ni
 - A. Welding Processes
 - B. Regulatory Scene
 - C. Implemented RMMs & Ocs
 - D. Information on relevant exposure levels
- STEP 5: compare results with GES table
- STEP 6: Discuss with Supply Chain

- Hazardous substances are generated (thermal cutting & spraying, soldering, brazing) in the form of gases (e.g., NO_x, HCHO, HCl, HCN, ...)

and/or

- fine/ultrafine particles (e.g. metal oxides such as Fe, Mn, Ni, Cd, Be, Zn, Co, Cr compounds, F, Ba compounds)
- The type and amount of the hazardous substances generated depend on the material and the process





The Regulatory Scene

- To limit the exposure of welders to hazardous substances at the workplace, regulators have **proposed exposure limit values**. These are often substance-specific (addressing key components of the fumes) and/or a general dust value
- Welding is not (**yet**) listed as a carcinogenic process in Annex 1 of the Carcinogens and Mutagens Directive 2004/37/EC.
- **NICKEL HUMAN HEALTH RISK REDUCTION STRATEGY:**
Evaluate welding as a process (including the possibility of an OEL), taking into account information in the nickel risk assessment reports, as well as other ESR reports on chromium(VI) compounds and zinc



The Regulatory Scene

Source « *Welding stainless steel – practical responses to regulatory trends* » Mr David Jordan

Current exposure limits for total welding fume and constituents

Country	Standard/Limit	Substance mg/m ³				
		Total fume	CrVI	CrIII	Ni (insol.)	Mn
UK	Workplace Exposure Limit (WEL)	(5)*	0.05	0.5	0.5	0.5 ¹ (1)
Germany ²		3 ¹	(0.1/0.05)	-	-	-
Netherlands	Maximum Allowable Concentration (MAC)	3.5	0.025	0.5	1.0	1.0
Sweden	Occupational Exposure Limit (OEL)	5	0.005 (0.02)	0.5	0.1	0.1 ¹ (0.2)
USA	Permitted Exposure Limit (PEL)		0.005 (0.05)	0.5	1	5

* Figures in brackets previous limits ¹respirable

²No limits for individual substances available under a 2004 ordinance (Gefahrstoffverordnung)

The proportion of each component of stainless steel welding fume governs its allowable concentration, rather than the total fume itself

=> Under REACH: recommend RMMs so that welder's health is protected according to the OCs.

The NI RA HH has shown that mean exposure ranges from 0.001 to 0.5 mg/m³ (MMA and MIG processes) (for both welding and cutting processes)

Higher Fume generation



Manual Metal Arc (MMA):
High Ni content electrode can be used



Flux Cored electrode
Welding (FCW)

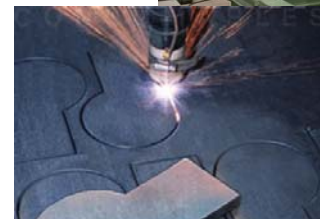
Lower Fume generation



Metal Inert Gas (MIG): *solid metal wire may contain Ni*



Submerged
Arc Welding
(SAW)



Plasma Arc Welding (PAW),
Tungsten Inert Gas (TIG): *no consummable gas electrode but filler wire may contain Ni*

Red box: : Ni present in amount > 1% in the composition of the Fumes

HAZARDS

- Welding fumes generally falls within respirable range:
 - potential lung cancer among welders through Inhalation

The American Welding Society reported that fumes produced by an E308-16 flux coated electrode contained spheres or clusters of spheres fused at high T of which 75% < than 0.2 μm , 24% < 0.4 μm , 0.2% > 1 μm



RISKS

- acute or short-term effects such as metal-fume fever, and/or respiratory tract effects associated with ozone or nitrogen oxides;
- long-term health effects on the skin, eyes, respiratory, cardiovascular, nervous systems;
- IARC review: evidence of excess mortality due to lung cancer in welders in all types of steels. However, the excess mortality could not be related to cumulative exposure to total fume, total Cr, hexavalent Cr or Ni.

Hierarchy of controls:

Elimination
Substitution
Engineering controls
Administrative controls
PPE

RMMs

Available Information:



Praktijkrichtlijn 'Beschrijving doeltreffende maatregelen bij blootstelling aan rook en/of gassen afkomstig van lassen en/of verwante processen'. 2006..... Ministry of Social Affairs and Employment, The Netherlands.

- Takes into account: the concentration of key components in the breathing zone of welders, duty cycle, process-material combination

e.g.: no special precautions required for welding stainless steel by TIG process. Separated ventilated space required for MMA with filter unit helmet or air-fed helmet.

- Use good practice at the workplace documents (UK)
- Training at workplace
- American welding Society: Safety in welding, cutting and allied processes



Does not exceed exposure levels listed for welding/cutting scenarios of NI Human Health RA

Template list GES

Process	Industrial Category	PROC	Operational conditions (OC)	Temperature of the process	Physical form of material	Physical form of exposure	Fugacity*	Relevant exposure routes for workers	Estimated exposure		
									inhalation tier 1 ECETOC TRA	inhalation (mg/m ³) (full shift) measured	dermal ECETOC
Example: Activities in smelters, refineries, coke ovens including gas production	Please specify if industrial and/or professional activity	Please indicate here PROC from current PROC list (see PROCs sheet)	Please specify volume (large or small) and give an estimation of duration of activity (>4 hours (default), 1-4 hours, 15 min-1 hour, <15 min)	Please estimate if process takes place at high or low (ambient) temperature	Please specify form of handled material: powders, massive, liquid	Please specify form to which workers are exposed to	for PROCs 21-25, defined according to melting points, for other PROCs defined on the basis of e.g. dustiness	Please specify relevant exposure routes for workers: inhalation and/or dermal	Please provide estimates from ECETOC-TRA for relevant PROC or other modelled estimates you may have	Please provide measured data if you have data available	Please provide estimates: ECETOC-TRA for relevant PROC or model estimates may have from EC doc
Welding, brazing, soldering, cutting, flame cutting.	Industrial Professional	25	small volume, >4 hours	high temperature	massive	gases, fumes	high: process temperature > melting point, moderate: process temperature at melting point, low: process temperature < melting point	inhalation	high fugacity: 5 mg/m ³		LEV pres. µg/cm ³ /day/cm ²
									moderate fugacity: 5 mg/m ³		No LEV pres. µg/cm ³ /day/cm ²
									low fugacity: 5 mg/m ³		
									high TYP 0.2-RWC 1.0		negligible
									mod TYP 0.2-RWC 1.0		negligible
									low TYP 0.2-RWC 1.0		
Industrial surface		13*				gases, fumes		inhalation			

Add consumers
use

Links with the GES Template

- **Exposure and RC estimation** for MMA and MIG Processes:

- Use The GES template to perform RC
- Estimate Consumers' (end users) risks
- If risk is identify use stricter RMMs
- Discuss with supply chain

- **RMMs**

- Worker's training;
- Good practice guidance;
- PPE (separated ventilated space required for MMA with filter unit helmet or air-fed helmet)



Next Steps

- Discuss the outcome with Stainless Steel Actors (**Fe, Mn, Cr** Consortia/EUROFER) & DUs
 - *Harmonize the ES phrasing and possibly, the recommended RMMs*
- Discuss outcome with Eurometaux **Human Health Project Team** (beyond REACH)
 - *compile and draft a process-based risk management guidance for welding*
 - *Review workshop with stakeholders*
 - *Publication guidance on RMMs*

Conclusions

- Importance of **preliminary phase** for ES drafting
- **GES** : starting guidance in iterative process
- Communicate with **other actors** of the supply chain and Consortia
- Welding
 - Up front the regulatory scene : should be treated as a **process** (?)
 - **REACH** creates the occasion to tackle welding and health protection
 - Will current Engineering controls and available RM guidance help meeting **more stringent limits**?
 - Need for **more research and development** to anticipate regulatory trends



Did we cover **all** working environments?

