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PROTOTYPE CHALLENGE

Electric Arc Furnace Explosions: A Deadly but Preventable Problem

Safety technician and three coworkers were attempting to stop a water leak in an EAF used to convert scrap metal into new reinforcing bars for construction. The furnace exploded, emitting hot steam and flying shrapnel, blowing out the front observation glass and the back window of the control room. The technician suffered severe burns and required surgery and hospitalization.

Safety First



Electric Arc Furnace- Operation

Communication

Productivity

Story : Electric Arc Furnace Operation

An electric arc furnace (EAF) is a furnace that heats charged scrap, iron ore by means of an electric arc. This furnace consists of refractory-lined vessel, water cooled upper shell panel and refractory lined roof, graphite electrodes. Scraps is melted at 2500 ° F with help of electrical power and chemical process by blowing oxygen and carbon in the furnace. Safe and reliable furnace operation is always challenging. Many fatal accidents happened in the past due to explosion in furnace and one of the root cause was due to water leakage in furnace shell panels.

We now try to understand how Ken, the operation manager of one of this type of electric arc furnace, handled the emergency situation during the scrap melting process

1
On June 25th, Ken was in meeting when he received call from operator about high furnace panel temperature



2
Ken discussed with team and found due to water leakage in one of the panel, cooling water flow is reduced and resulted in high panel temperature



3
Ken made phone calls and emails to stakeholders- Maintenance, Safety, Planning crew, Raw Material Stores, Power Demand manager, Top Management about abnormal furnace condition



4
After finishing supervision of panel repair works, Ken normalized the production and analyzed condition. Prepared breakdown report including cost to company and submitted to management



Persona : Electric Arc Furnace Operation

Ken

The Operation Manager



I like effectively utilize production and technical resources to achieve business goal

Responsibility:

- Complete responsibility of Electric Arc Furnace profit center including Operation, Maintenance activities

Needs:

- To know furnace critical operating parameters
- To know estimated time to repair and actual time to repair
- To know planned shutdown activities
- Proper and timely communication with all stakeholders

About:

- Metallurgy Engineer
- Master in Business Administration
- 20+ years of experience in metal industry
- Six Sigma Black Belt Champion
- Lead internal auditor for ISO quality
- Member of Safety Committee

Main Goal:

- Safety of people
- Furnace uptime by 99%
- Reduce yield and improve productivity
- Timely communications with stakeholders

Pain Points:

- Lots of time wasted in gathering related information.
- Proper and timely communication to all concerned stakeholders

Point Of View (POV) : Electric Arc Furnace Operation

Ken

The Operation Manager



Need a way to:

- Reduce the time wasted in gathering related information.
- Proper and timely communicate to all concerned stakeholders about furnace abnormal condition




So that :

- Reduce time for non productive work and have more focus on people's safety and furnace productivity
- Timely communication reduce the cost of unutilized resources like power and timely internal – external customers are informed.

User Experience Journey: Electric Arc Furnace Operation- As-IS process

Ken






The Operation Manager

ACTIONS	information from operator –furnace temp high	Information to Maintenance crew to start repair work	Information to stakeholders	Supervise the repair work	Normalize the furnace
MINDSET	<ul style="list-style-type: none"> -What is furnace temperature? -What is difference between incoming and return line water flow in panel? -What is furnace power and oxygen parameter? 	<ul style="list-style-type: none"> -What is the estimated time to repair -Is Safety of people working on floor assured? -What is Estimated production loss and contingency planning -Can we utilize the downtime to other shutdown activities? 	<ul style="list-style-type: none"> For power manager -What is estimated Power demand for next one hour. For warehouse manger -What is estimated raw material demand for next one hour For caster and other down stream production clients: -What is the estimated time for tapping the next heat/batch. For Fire Safety Department: -What is probability of any potential explosion For top Management: -concise status report and action taken 	<ul style="list-style-type: none"> -What is the actual time to repair -What are the problems faced during repair -How is emergency readiness and how to improve -Are work done in safe environment or any unsafe work? 	<ul style="list-style-type: none"> For inspection manager: -what is the furnace health for startup? For production planning manager: -Is the product in furnace is non confirmative /do we have to divert?
FEELING	 Sad  More happy 				
TOUCH POINTS	Phone, Computer-Email	Phone, Computer-Email	Phone, Computer-Email	Computer-draft report/notes	Phone, emails, Computer report

Mockups : Electric Arc Furnace Operation

Operation summary : Important process parameters, Notifications, Furnace present view

Electric Arc Furnace - Operation


 76.82 Deg F UPPER SHELL EAF Shell Panel Temperature More Details	 32.0 PSI UPPER SHELL EAF Shell Panel Water Pressure More Details	 31.9 GPM UPPER SHELL EAF Shell Panel Water Incoming Flow More Details	 31.9 GPM UPPER SHELL EAF Shell Panel Water Outgoing Flow More Details	 Status Report FURNACE Communications More Details
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Messages


FURNACE NEXT BATCH PLANNED AT 1:00 AM 08-26-2017
FURNACE POWER DEMAND 120 MW
BATH STEEL TEMPERATURE 1125 DEG F, OXYGEN 130 PPM
[More Details](#)

CLOSED SHIFT NOTIFICATIONS

DRONE CAMERA

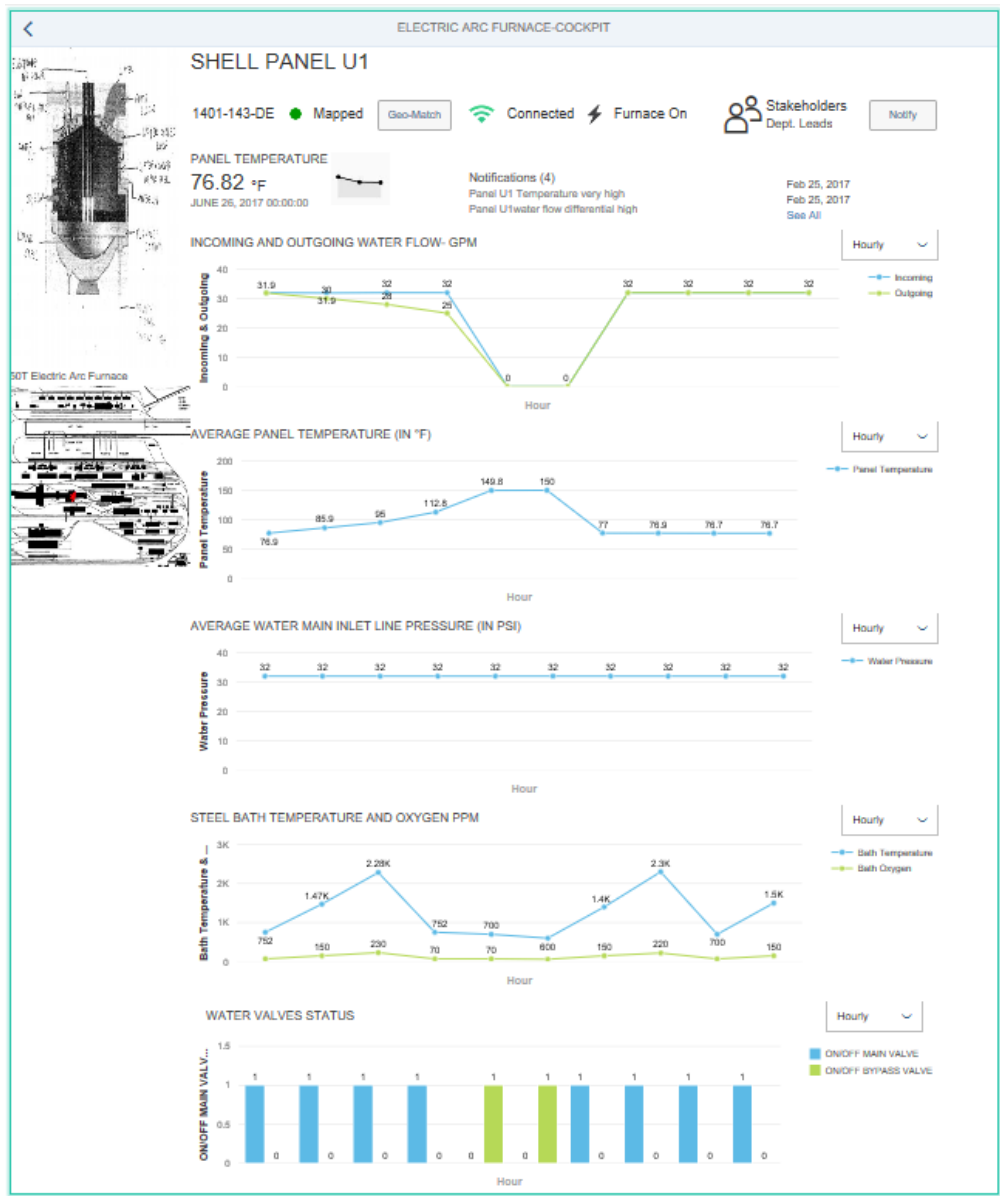


DRONE SHOP FLOOR :12:56 PM 08-26-2017
[More Images](#)

Weather News Alert 

Mockups : Electric Arc Furnace Operation

Operation important process parameters details



Communication with stakeholders and reports

Communication Cockpit

Select the stakeholder

- Top Management- C Group
- Fire- Safety Department
- Caster - Downstream Customers
- Power Portfolio Manager
- Raw Material Warehouse Manager

Communication History

June - July 2017

Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu
29	30	1	2	3	4	5	6	7	8	9	10	11	12	13

Communication reports

Communication Report

Stakeholder	Subject	Email/Voluntary Date and Time
Top Management- C group	Second Shift Report	05-25-2017 02:00 AM Date and Time
Caster-Downstream Customers	Furnace Breakdown	05-25-2017 04:33 PM Date and Time
Power Portfolio Manager	Furnace Breakdown	05-25-2017 04:32 PM Date and Time
Raw Material Warehouse Manager	Furnace Breakdown	05-25-2017 04:31 PM Date and Time
Fire- Safety Department	Furnace Breakdown	05-25-2017 04:33 PM Date and Time
Top Management- C group	Second Shift Report	05-25-2017 02:00 AM Date and Time
Top Management- C group	Second Shift Report	05-24-2017 02:00 AM Date and Time
Top Management- C group	Second Shift Report	05-23-2017 02:00 AM Date and Time

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https://standard.build.me/prototype-editors/api/public/v1/snapshots/a075a51b3fa728de0e170a0b/artifacts/latest/index.html#/launch_page