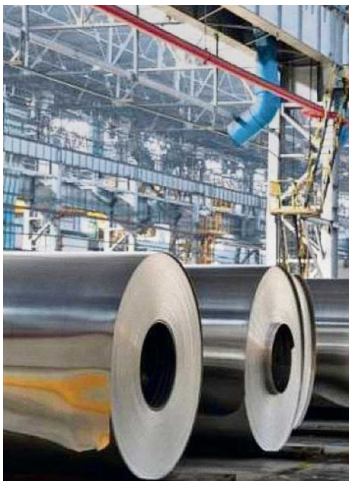
FINEAMIN®
SWISS WATER-TREATMENT CHEMICALS

PROVEN ANTICORROSION FILM FORMING WATER-TREATMENT CHEMICALS

MARCH 2021

REPLACING HYDRAZINE WITH POLYAMINES FOR ALUMINA REFINERY BOILERS



INTRODUCTION

Alum SA, is the sole alumina refinery in Romania, with a production capacity of 600.000 tons per year, and is part of one of the largest vertically integrated aluminum manufacturers group in Europe, ALRO, which has been operating since 1965.

ALRO GROUP mainly uses Alum SA's output for aluminum production.

Plant owner:	Alum SA, Tulcea, Romania
Plant type:	Alumina Factory Power Plant
Treatment start date:	2011
Boiler manufacturer	VULCAN
Steam production	200 TPH
Steam turbine	12 MW

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1 CONTEXT

In 2009, Alum SA restarted operations after a complex upgrade program that began in February 2007. In the following years, Alum SA has been modernizing all of the internal processes as well as working to increase the efficiency of the factory, while complying with the European Union's latest norms on environmental protection.

Following the implementation of the upgrade program, ALUM requested in 2010 from the FINEAMIN local distributor in Romania, Blue Neon LLC, to search for a modern water treatment solution that could replace the old boiler water conditioning regime. At that time, the boiler treatment was based on 150 kg per month of hydrazine 1%, injected after the deaerator, and on 600 kg per month of ammonia, injected before the deaerator. No phosphates were used.

Boiler no.	Projected steam capacity	Actual steam production	Pressure	Superheated steam temperature
Boiler 1	105 TPH	100 TPH	17 bar	250 °C
Boiler 2	120 TPH	100 TPH	100 bar	540 °C

The system is fed with demineralized water. As an alumina factory, with steam used in the production process, the quantity of non-suspicious, clean condensate return is relatively small. About 50% of the steam produced is going to a power turbine, while 50% is used in the production process and could be polluted with silica, iron or other materials. No condensate polishing unit is present.

2 SOLUTION

In August 2010, FINEAMIN specialists proposed a treatment solution for the two boilers of the plant: applying an all volatile treatment, FINEAMIN 90, which is a ready to use mixture of surface active, film-forming, volatile and alkalizing amines and aliphatic polyamines.

Based on to the system parameters, an adequate dosage rate proportional to feed water was proposed, to be injected after the deaerator. Technical approval from the management was obtained within one month. However, a request was made for a second option that would help maintain the dissolved oxygen levels compatible with the ISCIR operational parameters (Romanian State Inspection for the Control of Boilers, Pressure Vessels and Lifting Installations).

In general, an oxygen scavenger is not required when using polyamines, because the protective film created is separating the metal from the water, and hence the corrosive oxygen is isolated.

However, in certain cases, oxygen removal is still desirable, for example in cases where condensate return is limited and extra protection of the deaerator is needed.

In the case of ALUM SA, the company had no previous experience with film-forming treatment. It was therefore decided to complement FINEAMIN 90 with FINEAMIN 88 SCAV 25, an amines based, non-toxic oxygen scavenger to eliminate any potential risk of corrosion.

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BLUE NEON

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FINEAMIN 90

FINEAMIN 90 is a mixture of aliphatic polyamines and volatile alkalising amines. The surface-active polyamines enhance the formation of a thin, homogeneous magnetite protection layer with a very stable structure. This protection layer prevents the contact of the electrolyte with the metal surface without reducing the heat transfer. FINEAMIN 90 protects the whole system, including steam and condensate pipes, due to the high distribution coefficient of the alkalizing components and the volatile amines. The combination of surface-active polyamines leads to a very effective protection against corrosion and scaling. Existing corrosion products and deposits get dispersed and removed gently. Using salt free FINEAMIN products leads to savings in water consumption and thanks to the improved heat transfer, reduced energy consumption. The performance of the whole plant gets increased, the overall system protection is improved, while the costs of operation will decrease.

FINEAMIN 90 has been independently tested and confirmed as ecologically and toxicologically harmless by health and hygiene institutes. Furthermore, it is almost entirely bio-degradable. For more details see EU safety data sheet.

FINEAMIN 90 generally gets injected as a diluted solution in a single point of the plant, using an adequate dosing station. The required quantity gets calculated by the service engineer regarding to the water quality and the characteristics of the plant.

The dosing point for steam generator plants should be fixed into the feed water pipe after degasification and extracting attemperator spray water. The determination of FINEAMIN excess can be analyzed by a test kit or using a photometric test.

FINEAMIN 90 is delivered as a liquid solution in drums of 30kg, 60kg or 210kg. For major customers, it is available in standard containers of 1000kg. In closed drums, with an ambient temperatures from 5°C to 45°C, it can be stored for up to 5 years.

2 SOLUTION (continued)

The new water chemistry anti-corrosion and anti-scale was meant to support:

- no staff exposure to dangerous products, as part of the company's effort to provide the best working conditions for all employees, in accordance with international standards. In this regard, a strong emphasis on the elimination of hydrazine was put;
- complete protection against corrosion for the newly replaced equipment;
- improved compliance with the European Union's norms on environment protection and biodegradability;
- simplifying the operation of chemical treatment by reducing number of chemicals;
- competitive production costs by reducing maintenance costs, water and energy consumption.

After meetings with existing users, training and instructions, a one-month trial was proposed, in order to demonstrated the benefits of FINEAMIN 90. The trial was accepted and started on February 21st, 2011, 13:00.

3 RESULTS

Before the introduction of FINEAMIN, the water analyses showed relatively low pH values in the system, particularly boiler pH. After the transition to FINEAMIN 90, boiler pH has been maintained in the desired range.

FINEAMIN 90 proved its efficiency in replacing the conventional treatment and no suplimentary oxygen scavenger was required. FINEAMIN also demonstrated great ease of operation and decreased overall operational costs.

As can be expected in an alumina factory, the returned condensate sometimes gets polluted. Previously, when water treatment was based on hydrazine, the workers immediately disposed of the condensate until the problem was fixed, to avoid polluted condensate. When using FINEAMIN, as polyamines travel within the whole system and protect it, the risks of polluted condensate action on metal decreases significantly and shut downs are not necessary. This was confirmed during the trial.

Consequently, the trial results met all of the expectations of the operational team, as well as those of the management.

Therefore, the factory continued using the product without pause between trial products and their first order (march 2011).

Although, the costs of polyamines chemicals were slightly higher than the combined costs of hydrazine and ammonia, FINEAMIN was selected as a replacement for the previous treatment.

Moreover, in the following months, after the formation of a stable polyamines film in the systems, the needed quantity of product decreased, leading to very attractive costs for chemicals as well.

As a follow up of the daily analysis, the functioning was optimum for the last 10 years. No operational problems were observed.

	pH		Conductivity	
	Min	Max	Min	Max
Feed water	8.8	9.1	7.4 µS	12 µS
Boiler	8.8	9.1	7.3 µS	12.8 µS
Condensate	8.5	8.7	6.3 µS	8.9 µS

Blue Neon LLC

The company's main activity is based on water treatment consultancy and chemical products distribution services, as well as dosing and measurement equipment for the industrial field on the Romanian & Moldavian market. It has been operating as a FINEAMIN products distributor since 2007.

The sales team is young and motivated, while their consultants have more than 30 years experience in water treatment for industrial applications.
Blue Neon LLC is specialized in boiler water treatment for plants, refineries, and factories that use steam generation for production.

The clients portofolio includes some the biggest industrial facilities in Romania: power generation plants, fertilizers manufacturers, alumina factories and others. Most part of the applications prove polyamines efficiency in high pressure boilers (up to 220 bar) and at high temperatures (maximum 540°C).

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