Tube Coating Questions

Name: Gary Steel

Company: Contact Energy Ltd, New Zealand

Year – Coating in Service: 1995- 2007

I am basing some of my answers on memory only, as I no longer work at this plant and so do not have access to files..
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1. **How long ago did you coat the tubes?**
   A: 1995

2. **What size (diameter and thickness) are your tubes?**
   A: 1" - 25mm, and approx 18 gauge

3. **What material are your tubes?**
   A: cu ni, but had fitted some titanium ones in air suction zones as trial

4. **How many tubes are there in the condenser?**
   A: 10,000 each side, making 20,000 per TA unit

5. **What was the condition of the condenser when it was coated?**
   a. ***How much wall loss?***
      A: varied from through –hole (plugged) to 20- 80% reduction

   b. ***How many plugged tubes?***
      A: > 5%

   c. ***How many pitted/damaged tubes?***
      A: <50%

   d. ***What was the failure mechanism(s) of failed tubes?***
      A: sea water entrained sand. Scouring out of material especially when shell lodged part way in

6. **What was the condition of ARZ versus main bundle?**
   A: worse, mainly due to ammonia attack from hydrazine dozing in boiler tubes, especially where tubes bundle supports were positined

7. **How long did it take to coat the tubes?**
   A: 3 weeks

8. **Were there any problems during the coating process worth mentioning?**
   A: None what-so ever, did not affect production, or staff on other plant

9. **Are there any environmental impacts when applying the coating?**

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A: None, fumes and dust nuisances all dealt with extremely well

10. **What is the condition now?**
    A: the tubes when I last inspected them in 2007 were still sound, there had been no leaks from this Unit (Unit 2 of 5). The power station is now decommissioned.

11. **Were all tubes coated? Was the full length coated?**
    A: only about 20% were coated, we selected worse ones based on our testing. The full length was treated.

12. **Did you recover failed tubes?**
    A: yes

    a. ***If yes, how big were the holes in the tubes which were recovered?***
    A: in the order of 1 --1.5 mm, but hard to see without removing tube.

13. **Did they coat both tube sheet and tubes?**
    A: yes

14. **What thickness of coating was applied?**
    A: epoxy, cannot remember trade name

15. **How thick is the coating now?**
    A: unknown

16. **Was there much of an effect on heat transfer, pre-coating vs post-coating?**
    A: none that we could verify,

17. **What effect does the coating have on micro/macro fouling?**
    A: seems to have prevented fouling more so than un- coated tubes

18. **Based on the condition, how long do you expect the coating to last before something further must be done?**
    A: We were told to expect 7 years when we started, they were still good at 12 years. (plant had done about 130,000 generating hours running when done, although the CW pumps had been run a lot longer than this.

19. **What do they plan to do at the end of the coating life?**
    A: plant decommissioned

20. **How do they rate the value of the coating?**

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A: excellent, beyond our expectations, saved us many hours down time due to no tube leaks, (Chloride spikes), cost was about 33% less than replacement, and also we consider tube inserts but these too did not comply well. Note we used nylon tube inserts at entrance to our tubes to stop marine debris from entering. These were removed first, tubes coated and then replace.

21. Do you clean the tubes? NO

a. With what?

A:

b. How often?

A:

c. Any damage to the coating as a result of cleaning?

A:

d. Is it easier/harder to clean the tubes?

A:

22. Does your unit cycle very much?

a. If yes, does the thermal cycling seem to cause problems with the coating?

A: We were a two –shift station, cycling was our function, - no issues at all

23. How many tubes have you plugged since coating, tubes not plugged before vs tubes which were previously plugged and recovered?

A: None of the coated tubes were plugged or leaked in the 12 years

24. Has data been collected with respect to the size of the hole plugged vs the integrity as tested by hydrostatic testing?

A: No

25. How do you test for leaks?

A: vacuum test- bubbler, Also used was flurescein dye. This was mixed into steam side and observed with 'black' uv light at tube ends,. Also we have reverted to flooding the LP steam side with water and blowing air into the waterbox, watch for bubbles come up, gives general location only

26. Has the coating had any impact on boiler chemistry?

A: none that could be detected

27. How does the coating fail? (i.e. flakes, chunks, dissolve)

A: has not been evident

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28. What impact(s) are there on the environment (CCW discharge) when the coating is damaged or wears away?
A: none evident

29. Any other items worth mentioning?
A: We also dosed with Ferrous Sulphate to mitigate metal loss.

We also coated a few tubes, as an experiment, to see what affect, if any, poor preparation might have on the coating. Some tubes had residue of seawater left on them, (ie not washed out with demin water). None of these tubes showed any sign of coating failure or delaminating after the 12 year period.

Curran International is a highly professional operator, using skilled and motivated staff. They were on our site to solve a major problem, and they did all and more than they claimed they could do. I would recommend them to you without any hesitation.
They also carried out work at another NZ plant, 1000 MW Huntly Power Station. This uses river water that had high concentrations of pumice, a highly eroding volcanic stone that floats.

Regards
Gary Steel
Project Engineer
