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Paper E – Plant Operating Chemistry – Best Learned in Reverse

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Abstract

"… a gut-level understanding of basic boiler-cycle chemistry parameters by those on the front-lines of operations and maintenance is fundamental to achieving reliable, high-availability plant performance" – *Ref Author 1*.
To that end, this paper presents Plant Operating Chemistry in exactly the reverse order to the norm. By starting with steam-cycle corrosion product transport – chemistry is not only dead simple, but related directly to the experience and OpEx observations of service-providers everywhere. Such insight ultimately leads to interest in the more-aggressive boiler-cycle species, primary circuit conditions, etc. – all highly preferable to the 'clouding-over-of-faces' upon mere mention of the 'c' word.

1. Introduction

This paper addresses the subject of Operating Chemistry via a 'three part massaging' scheme which is common to the papers of this session. The three part messaging scheme is as follows;

i. Utility-Executive Level NIOU* Statement (by: Author 1)
ii. The Importance Shake-Down Discussions (by: Author 2)
iii. A Service-Provider Thoughtful-Tutorial (by: Author 3)

Management of the effects of operating chemistry and its relentless optimization are of fundamental importance to the life of any nuclear plant – unfortunately the perception of chemistry by those on 'the front lines of operations and maintenance' as something no mere mortal could ever fathom, defeats much effort towards excellence. That opacity is exacerbated by the impenetrable language of chemistry-speak which causes the faces of us lay-people to cloud over at the mere mention of the "c" word. As discussed herein – "… it doesn't have to be that way".

Further to Item i) above, discussion of this subject needs to start with a clear, high-level statement regarding "… the needs and interests of the operating utilities* (NIOU*)" as expressed at the Utility-Executive level - see Section 2.

Having been exposed to the NIOU statement as noted above, it is time to move on to discussion in Item ii) [aka 'importance shake-down discussions'] of - "… why is this important/ what will it really do for us/ what is wrong with the status quo anyway". The objective here is to get all of such questions (and any arguing) out of the way so we can move on to Item iii) - see Section 3.

Finally we come to Item iii) – which provides a thoughtful tutorial by someone with a bit of basic chemistry knowledge, a strong service-provider perspective, and a lot of OpEx experience - see Section 4.

2. The Utility-Executive Level NIOU Statement (by: Author 1) to follow

3. The Importance Shake-Down Discussions (by: Author 2) to follow

4. The Service-Provider Tutorial (by: Author 3) to follow

The following ('…') is a remnant of any earlier draft – to be used or discarded as appropriate -

'- … that is to be found in the exposing of operations, maintenance and service-provider people to chemistry in the *exact reverse order* to current practice. I.e - start with the boiler water circuit and focus first on its corrosion product transport - the monitoring and correction of which are the primary challenges of any outage program – then learn about optimum corrosion product transport (CPT) levels (Feed-water Iron < 1-2 ppb) - then do a mental calculation of annual transport quantities – then think about what that means in terms of deposition-distribution – and the necessary inspection and cleaning programs.

Armed with the above introduction to chemistry involving; the basic concept of CPT, one operating parameter value, and one mental calculation – those involved with equipment are inspired in their efforts in dealing the effects of chemistry and in supporting its optimization. And having become engaged, they will soon realize that there is more to, at which point their curiosity will carry the day.

This paper is - part 'participatory tutorial', based on the above involving at least one mental calculation to consolidate insight – and part 'getting the message out' regarding the importance of diligent operating chemistry optimization for plant maintainability and long-term reliability.'

5. Conclusion

A gut-level understanding of basic boiler-side chemistry on the part of those responsible for system and equipment condition, operation, and maintenance, and which has been built upon their own base of experience and observation - is fundamental to the achievement of sound operating and maintenance practice, reliable system and equipment performance, and high capacity factors. The alternative is a culture where 'faces cloud over' at the mere mention of the 'c' word.

Basic boiler-side chemistry is very simple and easily taught (e.g. – 'annual CPT' to an SG can be calculated in one's head with only one flow parameter and one chemistry value) – and even more

importantly it relates directly to the experience and OpEx observations that is every service-provider's life.

The key is to introduce operations people and service-providers to plant chemistry in exactly the reverse order to normal teaching practice. I.e. – start with the causes and effects of steam-cycle corrosion product transport/ boiler-cycle chemistry - and with that bit of insight the mysteries of plant chemistry will unfold little by little and layer by layer. Think of this – a situation where the plant chemists can't get their work done due to being pestered for - "… how are today's CPT numbers – we need them for our life-cycle management planning" – how good would that be. Given half a chance it can and will happen.