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From: WEAVER Keith -NUCLEAR <keith.weaver@ontariopowergeneration.com>
To: "'jps1@nrc.gov'" <jps1@nrc.gov>
Date: Wed, Jan 3, 2001 10:57 AM
Subject: Comments on Draft Regulatory Guide DG-1102

John,

As discussed this morning, the comments prepared by Clara Wren and me are attached.

Please feel free to contact either of us if you need further information or clarification on any of our statements. Our telephone numbers are:

Weaver: 416-592-4050
Wren: 613-583-3311 Ext. 3065 (She is out of the office until January 11)

Clara's e-mail address is

wrenj@aecl.ca <mailto:Wrenj@aecl.ca>

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CC: WREN JC Mr -AECL <WRENC@CR.AECL.mm.hydro.on.ca>

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E-RIDS = ADM-03
Add = Ann Beaweck (AFB)

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Rules and Directives Branch
Office of Administration
U.S. Nuclear Regulatory Commission
Washington, D.C.
20555-0001

Dear Sir;

Comments on Draft Regulatory Guide DG-1102

We have read this draft guide with interest, and in response to your request for public comments we offer the following observations.

Based on a long-term study and test programme, we have concluded that the kinetics of iodine adsorption on charcoal are of primary importance in defining performance measures for impregnated charcoal, in designing tests to confirm charcoal characteristics, and in interpreting the results of any such tests. The purpose of this letter is to identify the work we have carried out, and to indicate, through comments, how we think this work could be applied usefully to DG-1102.

The focus of our comments is on Section 7 of the draft guide "Laboratory Testing Criteria for Activated Carbon".

Comment 1. Impregnated charcoal is very effective at removing both molecular and organic iodine species. The extent to which this statement must be taken literally appears not to be reflected in the draft.

For a charcoal bed 20 centimetres (8 inches) deep, a DF of 10^{10} for organic iodide would be low. Values as high as 10^{30} have been determined. Furthermore, these high values have been seen in charcoal which has been in service for up to six years. (It is immediately obvious that any measurement yielding this sort of result separates the notion of the adsorption of iodine by charcoal as a medium, from the notion of iodine removal by the charcoal filter as a component of

an engineered system. In other words, different tests must be used to determine "penetration" and "bypass", and these concepts themselves must be carefully defined.) DF values this high are not derived from speculation but from solid measurements. Performance at this level indicates how important it is to be very clear as to what one is measuring, and how easy it could be to try to measure something which is in practice unmeasurable, the end result of which could be to quantify only the errors.

Comment 2. Test methods which do not recognise the significance of iodine adsorption kinetics in charcoal may not be focussing clearly enough on the characteristic being measured. It appears from the draft standard that the perception of a charcoal filter is based, at least to some extent, on the "stirred tank" concept, and that a charcoal filter can be seen as having measurable macroscopic properties, independent of scale.

In our tests, described in Reference 1, the property or characteristic being measured directly is the concentration of adsorbed I-131 as a function of depth into the test bed of charcoal downstream from the leading face. From the theory of iodine adsorption onto impregnated charcoal, this measurement can be converted readily into an adsorption rate constant. Once this rate constant has been obtained, the DF for a bed of any depth can be determined. We have carried out many tests (and numerous duplicate tests on individual batches of charcoal) and we find that the sensitivity of these tests is excellent, and that their reproducibility is good to within a few per cent.

The test D3803 attempts to measure "penetration". In addition to temperature and RH, unless the bed depth, gas flow, bed porosity, challenge concentration and compensation for background are reasonably well controlled, measurements which are to be interpreted as penetration can be subject to very large and highly variable errors. In the extreme (which may be easy to attain), these errors can render the measurements unrepeatable or meaningless.

Comment 3. The mechanisms of iodine adsorption as functions of temperature and relative humidity are reasonably well understood. Increasing temperature and increasing relative humidity act in opposite directions in their effect on the overall ability of charcoal to adsorb iodine, so the mechanisms associated with them must be taken explicitly into account in situations where temperature and RH are allowed to vary independently. Note that iodine adsorption on charcoal improves with increasing temperature, not because of charcoal recovery or regeneration, but because of the effect of increased temperature on the adsorption kinetics.

These comments lead to the following suggestion.

The procedure for the D3803 test which you have put forward should be reviewed in the light of the established understanding on the mechanisms of iodine adsorption and retention on impregnated charcoal (see References 1 and 2). The objectives of such a review should be:

To ensure that the test and the test procedures are designed such that when the test is carried out

it consistently takes adequate account of the most important variables and factors. Unless this can be assured, the test results from a single laboratory may not be repeatable, and test results from different laboratories may not be comparable. More importantly, the interpretation of ***any*** test may not be meaningful, since it may not relate to a consistent set of useful charcoal characteristics.

To ensure that the pass/fail criterion for the test, and any guidance for use in comparing the test results to that criterion, can distinguish reliably between good charcoal and bad. The importance of this capability, in avoiding both Type I and Type II errors (as one might designate them), is evident.

If you decide to move forward on this suggestion, we would be pleased to participate.

Yours sincerely,

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References

Wren, J.C. et al., Methyl Iodide Trapping Efficiency of Aged Charcoal Samples from Bruce-A Emergency Filtered Air Discharge Systems, Nucl. Tech., Vol. 125, No.1, 28-39 (1999).

Wren, J.C. et al., Modelling the Removal and Retention of Radioiodine by TEDA-Impregnated Charcoal Under Reactor Accident Conditions, Nucl. Tech., Vol. 125, No.1, 13-27 (1999).

From: John Segala
To: Lesar, Michael
Date: Thu, Jan 4, 2001 2:33 PM
Subject: Fwd: Re: Comments Regarding Draft Revision of RG 1.52

Mike,

I received the attached public comment from Keith Weaver and Clara Wren from the Atomic Energy of Canada Limited (AECL) via e-mail regarding my draft revision to RGs 1.52 and 1.140 (DGs 1102 and 1103).

Please enter it into your tracking and numbering system.

Thanks

John Segala

CC: IQBAL, Naeem, Mano