From:	Ullrich, Elizabeth
To:	Durkee, David J
Cc:	Watters, Eric
Subject:	RE: cyclotron termination - additional questions regarding potentially contaminated steel in vault
Date:	Thursday, July 17, 2014 11:24:00 AM

Thanks very much for the update. I am interested in seeing the results. No problem on the timing.

Betsy

From: Durkee, David J [mailto:David.J.Durkee@pfizer.com]
Sent: Thursday, July 17, 2014 11:09 AM
To: Ullrich, Elizabeth
Cc: Watters, Eric
Subject: RE: cyclotron termination - additional questions regarding potentially contaminated steel in vault

License No. 06-05869-03
Docket No. 030-38124
Control No. 583584

Hi Betsy,

I have reviewed your letter and have been in touch with Dave Culp at Chase Environmental Group. Mr. Culp stated that they have metal rebar in the samples that they obtained and analyzed from the cyclotron vault. He stated that he intends to pull the rebar from the concrete samples and have the metal assessed separately. He will then provide us with appropriate calculations based on a revised source term for the steel remaining at the facility. He stated that this work may take up to 4 – 5 weeks to complete. Mr. Culp also stated that he may try to contact you directly on our behalf to clarify some information.

As soon as I receive the revised calculations from Chase, I will develop and forward a signed response to your attention.

If you have any questions or concerns, please contact me.

Sincerely,

David

David Durkee
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From: Ullrich, Elizabeth [mailto:Elizabeth.Ullrich@nrc.gov]
Sent: Monday, July 14, 2014 2:47 PM
To: Watters, Eric; Durkee, David J
Subject: cyclotron termination - additional questions regarding potentially contaminated steel in vault

License No. 06-05869-03
Docket No. 030-38124
Control No. 583584

Pfizer, Inc.

Dave and Eric,

The NRC staff reviewed the licensee's approach of developing one set of DCGL values for surface contamination and another set of DCGL values that accounted for both surface and volumetric contamination and found the approach to be acceptable. The NRC staff reviewed the licensee's selection of DCGL values for total and removable contamination in areas without activated components and found the selection of $DCGL_{Total}$ of 7100 dpm per 100 cm_2 and $DCGL_{Removable}$ of 710 dpm per 100 cm_2 based on default screening values for Co-60 to be
acceptable for this site.

The NRC staff reviewed the licensee's approach to develop one set of DGCL values that combines surface and volumetric contamination to apply to areas with both surface contamination and volumetric activation products. Although the areas where each set of DCGL
values (i.e., surface contamination only as compared to surface contamination and volumetric contamination) were not delineated in the submittal, the licensee appears to have applied both $DCGL_{Total}$ values (i.e., 7100 dpm per 100 cm_2 and 10 µrem per hour) to the entire site, as well as the more restrictive of the two $DCGL_{Removable}$ values (i.e., 150 dpm per 100 cm_2). The NRC staff found this approach to be acceptable. The NRC staff found the $DCGL_{Total}$ value of 10 µrem/hr and $DCGL_{Removable}$ value of 150 dpm per 100 cm_2 would limit doses to below 25 mrem/yr in a building occupancy scenario.

The NRC staff reviewed the licensee's analysis of the potential dose that could be caused by residual contamination in concrete and steel remaining in the cyclotron vault under alternate scenarios. The NRC staff agreed with the licensee's conclusion that the residual contamination
in concrete at the site is not expected to exceed the dose limit in alternate scenarios. However, because the activation products in steel are expected to differ from the activation products in concrete, and because the licensee did not characterize the radionuclides present in
the remaining steel at the site, the NRC staff was unable to determine if the licensee's analysis included all of the radionuclides that could be relevant to recycling or disposal of activated steel from the site. Therefore, the NRC staff was unable to verify the licensee's conclusion that the

residual contamination in steel at the site would meet the dose limit in alternate scenarios. This conclusion could be verified if the licensee provides justification for the assumption that the source term developed based on samples of concrete represents or bounds the source term in
the remaining steel at the site. Alternately, the licensee could perform additional calculations based on a revised source term for the steel remaining at the site.

Details regarding evaluation of the DCGL involving steel

The lower end of the range of volumes considered in NUREG-1640 was 14.7×10^3 metric tons of concrete cleared in 1.7 years. Rounding 1.7 years to two years, the lower bound of the annual contaminated concrete removal rate used in the NUREG-1640 is 7.3×10^3 metric tons in
one year. The licensee estimated that less than one metric ton of potential activated steel remained at the site, and adjusted the dose by a factor of 1 metric ton divided by 7.3×10^3 metric tons, or 0.02% (Table 5). The NRC staff duplicated these calculations.

Table 5. Alternate Scenario Dose Estimate for Volumetrically Contaminated Steel

Nuclide	Average Activity Concentration (pCi/g)	Mass-Based Scenario DCF (mrem/yr per pCi/g)	Dose Using NUREG-1640 Volume Assumptions (mrem/yr)	Volume-Corrected Dose (mrem/yr)
Co-60	0.63	0.192	0.12	6.8×10^{-4}
Cs-134	0.12	0.163	0.02	1.1×10^{-4}
Eu-152	0.72	0.081	0.06	3.3×10^{-4}
		Total	0.20	1.1×10^{-3}

As discussed in Section 2, because the elemental composition of steel and concrete differ, they are expected to have different activation products. Thus, the source term that the licensee used, which was based only on samples of concrete, may not represent the contaminant
concentrations in activated steel in the cyclotron vault. Therefore, the concentrations of Co-60, Cs-134, and Eu-134 that the licensee measured in concrete could underrepresent the concentrations of those radionuclides in steel. In addition, it is possible that the estimated dose
should include other radionuclides in addition to Co-60, Cs-134, and Eu-152.

The Licensee's surface scans performed with a sodium-iodide (NaI) detector and tissue equivalent gamma scintillation meter provide assurance that gamma radiation at the accessible steel surfaces was not significantly higher than gamma radiation on the concrete surfaces. However, insufficient information was presented about the volumetric concentration. In addition, it is unclear whether there could be significant concentrations of alpha or beta-emitting radionuclides that are common activation products in steel (e.g., Ni-63) in the steel, which could
become inhalation or ingestion hazards in alternate scenarios such as recycling. For this reason, the NRC staff was unable to determine if volumetric activation products in steel

could present a hazard in alternate scenarios based on the information provided by the licensee.

In order to complete our review of your decommissioning activities and to terminate the license, please provide justification for the assumption that the source term developed based on samples of concrete represents or bounds the source term in the remaining steel at the site. Alternately, the licensee could perform additional calculations based on a revised source term for the steel remaining at the site.

Please provide your response in the form of a singed hard copy letter OR a pdf or facsimile of a signed hard copy letter. If you have any additional questions, please contact me.

Betsy

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