

## HLWYM NPEmails

---

**From:** Oleg Povetko  
**Sent:** Wednesday, May 30, 2007 3:12 PM  
**To:** Christopher Ryder  
**Cc:** Razvan Nes; Sheena Whaley  
**Subject:** RE: FW: Consequences From Dropping a Transfer Cask

Thanks, Chris,

I was not familiar with the thermal management details and, given assumed HOLTEC thermal management measures the operation is more complex than I thought and the goal is not to let water boil for bounding fuel during normal operations. We might only speculate at this point what will be the emergency procedures in case of a drop of STC, after workers left the area and the radiological emergency assessment process is on-going for some time. There should be some immediate response measures planned to prevent water from boiling.

Oleg.

> -----Original Message-----

> From: Christopher Ryder [mailto:CPR@nrc.gov]

> Sent: Wednesday, May 30, 2007 12:25 PM

> To: Oleg Povetko

> Cc: Razvan Nes; Sheena Whaley

> Subject: RE: FW: Consequences From Dropping a Transfer Cask

>

>

> Oleg,

>

> See attached file.

>

> Chris

>

>

> >>> Oleg Povetko <opovetko@cnwra.swri.edu> 05/29/2007 4:19 PM >>>

> Thanks, Chris, for you prompt response.

>

> I have couple points to make.

>

> -In our scenario STC is not filled with water, only TAD canister. We

> roughly estimated it's cavity net free volume as 5,040 L (3/4 of

> MPC-24 net free volume ). It approximately corresponds to (5040/4410 )

> L/rod = 1.1 liter of water per rod. It would correspond approximately

> to 3.3 mm of effective radial water thickness per fuel rod along its

> length (meaning taking into account all water circulating inside TAD).

> This doesn't look like a lot of naturally circulating cooling water

> for a fuel pin 11 mm in diameter.

>

> - The STC transfer operation is slow, might take hours (?), so the

> cladding surface temperature may rise during transfer

>

> - From TAD perf.specs I estimated required amount of steel to shield

> maximum PWR fuel down to 800 mrem/hr on top surface.

> It would require about 1 foot of steel for Co-60. So, the lid is

> expected to be heavy. But there might be air gap between water surface

> inside TAD and lid, so the heat transfer to the heavy lid might not be  
> very effective.  
>  
> It's hard for conclude without thermohydraulic analysis that there  
> will be no limited bubble formation on cladding surface after hours  
> (?) of transfer.  
>  
> Oleg.  
>  
>  
>>  
>>  
>> Oleg,  
>>  
>> During the transfer, the TAD is filled with water. The  
> fuel is cool -  
>> at nearly the same temperature as the water. Even the centerline  
>> temperature of the fuel is cool - only about 20 degrees C  
> higher. The  
>> water is drawing the heat away and depositing it on the TAD  
> itself.  
>> The water inside the STC conducts the heat to the overpack.  
> The STC  
>> can passively reject some of the heat.  
>>  
>> If the STC, with a flooded TAD, were left on the floor  
> indefinitely, I  
>> suppose that the water would eventually boil. Someone  
> would have to  
>> do thermal calculations to determine the rate of heat  
> generation and  
>> rejection to confirm this. When the TAD is removed from the  
> pool, it  
>> is cool. The heat up from spent fuel should take more time  
> than the  
>> operation. I do not know how long this would take, but it is  
>> relatively much longer than the operation. There is a lot  
> of mass to  
>> heat - fuel, water, steel - and the fuel is old.  
>>  
>> When the TAD is drained, the fuel temperature increases to  
> about 300  
>> to  
>> 400 deg C. Air is much more of an insulator than water. By  
>> this time  
>> , the TAD has been on the floor and is being sealed.  
>>  
>> The lid would not be dislodged. I believe that the current  
> plans are  
>> to make the lid thick enough to provide shielding. It would  
> be about 1  
>> foot thick. My guess (not knowing the  
>> dimensions) is that the lid would weigh about 700 pounds. It is  
>> surrounded by the TAD shell. To dislodge it would mean  
> that it would  
>> have to move upwards about a foot. Also, the STC lid is

> bolted to the  
>> STC overpack. The bolted lid would keep the TAD lid in place, and  
>> water of inside the TAD.  
>>  
>> Briefly, the solid mass of water, fuel and steel, will keep  
> the fuel  
>> temperature down, close to the pool temperature, which is about at  
>> room temperature. There will be no water boiling.  
>>  
>> Chris  
>>  
>> =====  
>>  
>> Christopher Ryder  
>> (301) 415-6102  
>> NMSS/HLWRS/SPAD/PAS  
>> High Level Waste Repository Safety  
>> Site Performance Assessment Directorate Mail Stop T 7 F23 Room T 7K2  
>> Tel: (301) 415-6102  
>> Fax: (301) 415-5397  
>>  
>> >>> Oleg Povetko <opovetko@cnwra.swri.edu> 05/25/2007 9:12 PM >>>  
>> Chris,  
>>  
>> Regarding your comment on CRUD below: if the fuel cladding  
> temperature  
>> is 300-400C during transfer and  
>> - there's not so much water available for circulation inside the  
> TAD,  
>> - no water inside STC,  
>> - lids are slightly dislodged after drop,  
>>  
>> Do you see a possibility that bubling would occur inside  
> the TAD and  
>> some crud will be transported out of STC with the bubbles?  
>>  
>> Oleg.  
>>  
>> =====  
>>  
>>> -----Original Message-----  
>>> From: Sheena Whaley [mailto:SAW2@nrc.gov]  
>>> Sent: Wednesday, May 23, 2007 8:35 AM  
>>> To: Oleg Povetko  
>>> Subject: Fwd: Consequences From Dropping a Transfer Cask  
>>>  
>>>  
>>>  
>>>  
>>> >>> Christopher Ryder 5/23/2007 9:21:53 AM >>>  
>>> Sheena,  
>>>  
>>> Please find attached a pdf file of the Dry Cask Storage PRA. We  
>>> studied the Holtec HI-STORM system at a BWR reactor. The DCS PRA  
>>> calculations may be of use to you and Oleg.  
>>>

> > > In Section 4.4.2, Fuel Rod Cladding Failure, page 4-15, Table 13  
> > (page  
> > > 4-26) gives the failure probabilities that we calculated. The  
> > > probability is taken to be either zero or one, depending  
> > on whether  
> > > the maximum principal strain in the cladding is less than  
> > or greater  
> > > than the strain limit selected for high-Burnup fuel. When the  
> > > transfer cask is dropped onto a concrete floor, the fuel is  
> > > predicted to fail when the drop height is somewhere  
> > between 20 and  
> > > 40 feet. Fuel that has pin holes in it will have already  
> > released  
> > > the nobles; the amount of additional release is insignificant.  
> > >  
> > > On page 4-27, we stated that to estimate a failure  
> > probability when  
> > > no failures have been observed, the 50% confidence limit can be  
> > > used; this  
> > > is a typical statistical practice. For a binomial distribution,  
> > the  
> > > 50% confidence limit when no failures have been observed is  
> > > calculated by dividing 0.7 by the number of reported  
> > times that fuel  
> > > assemblies were dropped. Thus, the probability of fuel assembly  
> > > failure is estimated as  $0.7/11 = 0.064$ . This may seem to  
> > be at odds  
> > > with the above. This calculation is based on an analysis of  
> > > empirical data. Lacking an engineering analysis as  
> > above, one would  
> > > do this empirical analysis. We did it anyway and used it in some  
> > > cases (I do not recall how) to do a probabilistic-type analysis.  
> > > The calculation is acceptable as long as one understands what is  
> > > being done.  
> > >  
> > > On page 7-6, Table 19, the results of the risk analysis  
> > is given.  
> > > When the transfer cask is moved from over the pool to the  
> > > preparation area, the lid is on, but not secured. The cask is  
> > > carried about 3 feet above the refueling floor. For the  
> > purposes of  
> > > risk, we said that a drop would dislodge CRUD that is  
> > available for  
> > > release. In fact, the CRUD would remain in the water of the cask.  
> > >  
> > > Appendix C discusses details of the response of spent fuel to  
> > > mechanical loads.  
> > >  
> > > Chris  
> > >  
> > >  
> > >  
> > >

**Hearing Identifier:** HLW\_YM\_NonPublic\_EX  
**Email Number:** 48

**Mail Envelope Properties** (opovetko@cnwra.swri.edu20070530151159)

**Subject:** RE: FW: Consequences From Dropping a Transfer Cask  
**Sent Date:** 5/30/2007 3:11:59 PM  
**Received Date:** 5/30/2007 3:11:59 PM  
**From:** Oleg Povetko

**Created By:** opovetko@cnwra.swri.edu

**Recipients:**

"Razvan Nes" <RNES@cnwra.swri.edu>  
Tracking Status: None  
"Sheena Whaley" <Sheena.Whaley@nrc.gov>  
Tracking Status: None  
"Christopher Ryder" <Christopher.Ryder@nrc.gov>  
Tracking Status: None

**Post Office:**

<b>Files</b>	<b>Size</b>	<b>Date &amp; Time</b>
MESSAGE	7854	5/30/2007 3:11:59 PM

**Options**

**Priority:** Standard  
**Return Notification:** No  
**Reply Requested:** No  
**Sensitivity:** Normal  
**Expiration Date:**  
**Recipients Received:**