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DARIUS DARUWAUA (210)-522-3297

This Notebook is used for preparation of the report on the DOE Surface Fire Hazard Analysis for the Repository at Yucca Mountain.

--SCIENTIFIC NOTEBOOK CO. --2831 LAWRENCE AVE. P.O. BOX 238 STEVENSVILLE, MI 49127 616-429-8285

Project No ... DOE Surface Fine Hazard Analysis Book No. 504 Dad 2/20/02 This Page left intertionally blank for nons. om Page No Ziralo Subject: Explore Possible Issue of Zirconium üssenbl as a Combustible Heat of Combustion of Zirconium: Zirconium or idation is an exothermic reaction with an energy release of 262 K cal/mole. The heat-Z/X generated will therefore tend to sustain the reaction, once started. (Draft Final Technical Study of 66 Spent- Fuel Pool Accident Risk al- Decommissioning Muclear Power Plants Feb. 2000. Heat of Compustion Calculations: , in Heat of Cembustion for Zirconium = 262,000 cal 91 gm Z 262 al 2202. 2/20/02 ristil 262,000 cal × 1 Btu 252 cal Sefer = 5,200 Btu 91 gm Zr x 116 454 gm A.A.N 2/20/02 ch To Page No. Date Witnessed & Understood by me, Date Invented by Recorded by

DOE Suface Fire Hayard Analysis.

Estimate of Fire Load from Combustible Zirconium Cladding In Assembly Handling Cell (AHC)

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There are 2 dryers + 1 Disposal Container in AHC. (CRWMS M& O, 2000, WHB/WTB Space Program Analysis for Sile Recommendation, Rev DO) The Disposal Centainer will hold around 21 PWR spent fuel assemblies (Science & Engineering Report, DOE 2001)

Assume three are 8 PWR Spent Fuel Assemblies and h the dryers and 21 PWR Spent Fuel Arsemblies in the Disposal Container at the time of the fire.

No Add: Hass of Zircoloy in the Assembly Handling Cell = (8+21) assemblies = 29 PWR Assemblies

There are 102.9 kg of Zircoloy-4 in the cladding of a POR assembly, and 51.2 kg of Zircoloy-2 in the cladding of a BOR assembly + 41.7 kg of Zircolog 4 in the fuel channel of a BOR assembly (Waster Form Characteristics Report, Rev. 1, LLNL, Livermore, Ca, April 1994) S.D.D. 2/20/02

TITLE DOE Surface Fire Hagard Analyces Book No 504 From Page No 2. Mass of Ziviolog in the AHC = 29 Assemblies × 102.9 kg Zirale üssenbly = (29×102.9) Kg x 2.2 1/3 = 6,565 lbs :- Mass of Zirrolog in AHC = 6,600 lbs Fire Load in AHC can be estimated at (6,600 lbs Zr x $5,200 Bt4 = 34 \times 10^6 BTU$ " Zirionium is by far the most prevelant combustible in the Assembly Handling Cell. Also, the five suppression system in this area must be suitable for zir conium fire suppression, in accordance with NFPA 482. However, the DOE has excluded Zirconium as a combustibu in its analysis for the present (Preliminary Preclosure Safety Assessment for Monitored Geologic Repository Site Recommendation. Rev OU ICN03). At the very least, therefore, it is important to track this issue in the DOE final design. DAD 2/20/02 Witnessed & Understood by me Date Recorded by

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Project No .___ TITLE DOE Surface Fine Hazard Analysis BOOK NO. 504 14 Subject: Explore possible issue of fire in arrive Prep. Bldg. Bay of Waste Handling Bldg. From Page No. From: Amitava Ghosh [aghosh@swri.edu] Sent: Friday, March 01, 2002 3:09 PM To: Darius Daruwalla Cc: Asadul Chowdhury Subject: RE: Discussion on February 28, 2002 aghosh.vcl Darius: This email summarizes the discussion I had with you yesterday (February 28, 2002) on fire hazard assessment for surface facilities at Yucca Mountain. (1) PFSF SER gives summary results of fire calculations because of its nature. PFS SAR gives more details and also refers to HI-STORM 100 FSAR for relevant analyses for fire hazard to a storage cask. (2) As discussed, before, we need to evaluate the operations in the Waste Handling Building regarding how the casks are brought inside -either using locomotives, or heavy-haul trucks/cask transporters. We also need to evaluate the capacities of the fuel tanks and number of such vehicles staying inside the building at one time. We also need to evaluate the closest distance these vehicles can come close to the SSCs that may be affected by fire. We also need to evaluate the floor configurations at the site to evaluate the fire characteristics. (3) As discussed before, we may not have all information that we need for an acceptable fire hazard analysis right now but will be looking for eventually. (4) As discussed, capacity of the fuel tank of a fork lift is significantly small compared to a cask transporter, a heavy-haul truck, or a locomotive. Although it is good to know and should be included in the inventory, its contribution may not be significant. If you remember any other issues we discussed, please let me know. I will included in this list. Amit Ghosh ANN. 07 To Page No. Witnessed & Understood by me, Date Invented by Date Recorded by

12	Project No Book No. 504 TITLE DOE Surface Fire Hazard Analysis	
From Page No		
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Fire - Additional Issues

1. **Issue:** The DOE has not provided sufficient analyses or calculations to demonstrate that the breach of a transport cask due to a fire in the Carrier Preparation Building or the Carrier Bay of the Waste Handling Building is incredible.

Basis: The DOE has stated that "there is no credible means by which a fire in the Carrier Preparation Building or carrier bay of the Waste Handling Building could cause a breach of a transport cask" (CRWMS M&O 2001). Transport casks entering the MGR are designed to withstand the severe transportation fire environment specified by 10 CFR 71.73 *Hypothetical Accident Conditions.* Therefore a Design Basis Fire would have to exceed the size and duration of such fires, to cause a breach in the cask. However, since there may be multiple diesel fuel driven vehicles at one time in either these two locations, the total fuel inventory in each area may be considerable. For example, there could be two diesel prime movers and a 20 ton forklift (CRWMS M&O 2000c) in the carrier bay of the Waste Handling Building, resulting in a total inventory of diesel fuel far in excess of the capacity of one vehicle. It is not clear if this has been considered by the DOE in their analyses.

Recommendation: The DOE should provide confirmatory analysis or calculations to demonstrate that the breach of a transport cask due to a fire in the Carrier Preparation Building or the Carrier Bay of the Waste Handling Building is incredible, or limit the total allowable fuel inventory in these locations to a safe maximum capacity. The DOE should specify this maximum allowable capacity.

This comment (issue) in draft form was genera	ted by v	ne and
given to Asad for comment on March 1, 2002 a		
My approach was based on the argueme.	nt that	there could
be multiple diesel powered vehicles in the location	ins of int	evest. Therefore
the total diesel fuel inventory could exceed the	capacit	y of one
diesel powered whiche, The assumption is that "10	CFR 7173	Hypothetical
Accident Conditions" is based on the hypothetical fire	from one	diesel vehicle
pulling the Carrier loaded with a transportation cash	(i.e."Norm	ral landitions
of Transport"). SAD =13 AND 3/1/2002.		To Page No.
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DOE Surface Fire Hazard Analysis Book No 504 From Page No.

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8.3.4 Design/Operational Features for Prevention/Mitigation of Fire-Initiated Radiological Events

Features of the MGR operations and facility design that prevent or mitigate the effects of the potential fire-initiated radiological hazard are described in the following paragraphs.

<u>Transport casks</u> entering the MGR are designed to withstand the severe transportation fire environment specified by <u>10 CFR 71.73</u>, *Hypothetical Accident Conditions*. Therefore, a radiologically significant design basis fire for the carrier preparation area and the carrier bay would have to exceed the size and duration of such fires. The FHA for the <u>CPB</u> shows that the fire level is moderate and, therefore, there is no credible means by which a fire in the <u>CPB</u> or carrier bay of the WHB could cause a breach of transport cask and a release of radioactivity.

Similarly, waste packages will be designed to withstand the same fire environment as transportation casks. The FHAs show that only low to moderate fire hazards exist in the primary functional areas of the WHB and the subsurface facilities, so it is unlikely that any credible fire in the WHB will approach the severity of a design basis fire for a transport cask. Therefore, after completion of the final seal weld, a fire-induced breach of a waste package is not credible at any point in the waste stream beyond the welding station inside the WHB.

Elsewhere in the WHB, bare SNF assemblies and sealed HLW canisters are handled. These operations are performed within the robust, non-combustible confinement structure provided by the WHB. The FHA shows that the fire hazard level is low to moderate for these operations areas. A design basis fire for these areas has to have temperature and duration sufficient to cause a breach of SNF cladding or HLW canister. It is unlikely that fires of sufficient severity can occur. Even if a release of radioactivity occurs, the radioactivity would be confined by the robust structure of the WHB and the confinement provided by the HVAC system. Further, the

TDR-MGR-SE-000009 REV 00 ICN 03

8-18

June 2001

17

From: Preliminary Preclosure Safety Assessment for Monitored Gerlogic Repository Site Recommendation.

The above is a copy of the DDE document (CRWMS M80 2001) referenced in "Basis" section of my draft issue on pg #12 of this reported notebook D. D. D: 3/1/2002 To Page No. Witnessed & Understood by me, Date Date Invented by Recorded by

Book No. 504 TITLE DOE Suface Fire Hozard Analysis.

§71.74

(4) Thermal. Exposure of the specimen fully engulfed, except for a simple support system, in a hydrocarbon fuel/air fire of sufficient extent, and in sufficiently quiescent ambient conditions, to provide an average emissivity coefficient of at least 0.9, with an average flame temperature of at least 800°C (1475°F) for a period of 30 minutes, or any other thermal test that provides the equivalent total heat input to the package and which provides a time averaged environmental temperature of 800°C. The fuel source must extend horizontally at least 1 m (40 in), but may not extend more than 3 m (10 ft), beyond any external surface of the specimen, and the specimen must be positioned 1 m (40 in) above the surface of the fuel source. For purposes of calculation, the surface absorptivity coefficient must be either that value which the package may be expected to possess if exposed to the fire specified or 0.8, whichever is greater; and the convective coefficient must be that value which may be demonstrated to exist if the package were exposed to the fire specified. Artificial cooling may not be applied after cessation of external heat input, and any combustion of materials of construction, must be allowed to proceed until it terminates naturally.

(5) *Immersion—fissile material.* For fissile material subject to §71.55, in those cases where water inleakage has not been assumed for criticality analysis, immersion under a head of water of at least 0.9 m (3 ft) in the attitude for which maximum leakage is expected.

(6) Immersion—all packages. A separate, undamaged specimen must be subjected to water pressure equivalent to immersion under a head of water of at least 15 m (50 ft). For test purposes, an external pressure of water of 150 kPa (21.7 lbf/in²) gauge is considered to meet these conditions.

§71.74 Accident conditions for air transport of plutonium.

(a) Test conditions—Sequence of tests. A package must be physically tested to the following conditions in the order indicated to determine their cumulative effect.

(1) Impact at a velocity of not less than 129 m/sec (422 ft/sec) at a right 10 CFR Ch. I (1-1-01 Edition)

angle onto a flat, essentially unyielding, horizontal surface, in the orientation (e.g., side, end, corner) expected to result in maximum damage at the conclusion of the test sequence.

(2) A static compressive load of 31,800 kg (70,000 lbs) applied in the orientation expected to result in maximum damage at the conclusion of the test sequence. The force on the package must be developed between a flat steel surface and a 5 cm (2 in) wide, straight, solid, steel bar. The length of the bar must be at least as long as the diameter of the package, and the longitudinal axis of the bar must be parallel to the plane of the flat surface. The load must be applied to the bar in a manner that prevents any members or devices used to support the bar from contacting the package.

(3) Packages weighing less than 227 kg (500 lbs) must be placed on a flat, essentially unyielding, horizontal sur-face, and subjected to a weight of 227 kg (500 lbs) falling from a height of 3 m (10 ft) and striking in the position expected to result in maximum damage at the conclusion of the test sequence. The end of the weight contacting the package must be a solid probe made of mild steel. The probe must be the shape of the frustum of a right circular cone, 30 cm (12 in) long, 20 cm (8 in) in diameter at the base, and 2.5 cm (1 in) in diameter at the end. The longitudinal axis of the probe must be perpendicular to the horizontal surface. For packages weighing 227 kg (500 lbs) or more, the base of the probe must be placed on a flat, essentially unyielding horizontal surface, and the package dropped from a height of 3 m (10 ft) onto the probe, striking in the position expected to result in maximum damage at the conclusion of the test sequence.

(4) The package must be firmly restrained and supported such that its longitudinal axis is inclined approximately 45° to the horizontal. The area of the package that made first contact with the impact surface in paragraph (a)(1) of this section must be in the lowermost position. The package must be struck at approximately the center of its vertical projection by the end of a structural steel angle section falling from a height of at least 46 m (150 ft). The angle section must be at least 1.8

Fire Criteria from 10 CFR Part-71.73 D.D.W. 3/1/2002

TITLE DOE Surface Fire Hazard Analysis Book No. 504 10 In researching my issue (Pg 12 of this notehook), Jaho looked at other DOE reports. Attached below are my Notes from an Access Database I have created for this report. Notes Remarks Min. 20 ft queing space ? Explore cask resistance to between loaded casks diesel fire accident. Up to two (WHB/WTB pg 23). From this Diesel Prime movers and one 20 ton forklift used in this area. and Fig I-13 assume up to 2 loaded casks in WHB Carrier Bay(WHBCB). See Fig I-13, 14, 15 for distances & configurations. Area of WHBCB 15,680sq ft, ht. 60 ft (WHB/WTP pg 24). Onsite diesel-driven prime movers (rail or tired vehicle) used (PPSA Rev 3 pg 4-5). Truck carriers one-way drive through. Rail carriers enter & leave from same end of carrier bay. 20 ton Forklift diesel with ~30 gal tank (Hyster Co.). Truck Site Prime Mover = 48 ton capacity, Rail SPM = 290 ton capacity (Carrier/Cask Prep & Transportation Systems Design Analysis Rev 00B pg 31). There are 3 truck and 3 rail SPMs, truck SPM 15 to 23 ft long, rail SPM 153 inches long; truck carrier ~42 ft long, rail carrier ~72 ft long (Eng Files for site Recommendatn Att II pg 115; Att I Fig I-7 to 10). N. N.D. 3/1/2002 To Page No Date Witnessed & Understood by me Date Invented by Recorded by

Project No .__

Book No. 504 TITLE DOE Surface Fire Hazard Analysis

From Page No.

16

March 4, 2002 (9:34AM)

Comments on Fire-Additional Issues by Darius Daruwalla (March 1, 2002)

Amitava Ghosh

The basis, as presented, does not establish it a valid comment as we have not established the credibility of the fire scenario as envisioned by us. A significant amount of work is needed before the comment can be a valid one. Some reasons are:

- We need to know what are the fire criteria under Part 71.
- We need to know the storage tank capacity of each prime mover and 20-ton forklift.
- We need to know the layout of the transportation cask handling areas of these two-buildings to determine the fire load (i.e., heat applied on a transportation cask) will be a simple multiplication of the number of prime movers present.
- We need to check any discussion of operational procedure that may limit the number of prime movers at one time inside these buildings.
- Based on this information as a minimum, we need to establish that the fire load that may be present exceeds the analyzed conditions under Part 71. Only then this comment, as written, is a credible and useful comment.

This comment, in my opinion, deals with confirmatory calculations and analysis that give a notion that we have investigated thoroughly DOE's analyses and calculations, and find an unanalyzed scenario. As far as I know, we do not have that much of the information to make such a strong comment at this moment. In my opinion, this comment should be presented in a different form. Several discussions I had on this topic and discussion summary of last Friday may lead to one possible way of framing the comment. Obviously, there are several approaches to tackle this issue. I do not understand why we are asking DOE for the maximum allowable capacity when DOE is following or has followed Part 71 fire criteria.

Note: The above comment is solely based on the text presented in the above-mentioned document and preliminary knowledge of DOE status of progress on this area. However, I have not read DOE fire hazard analysis in detail to know exactly what information is available at this moment. Still, in my opinion, we need to answer the above steps to present a valid comment to the DOE, as given in the above-mentioned document, otherwise present in a different way. I did not revise or rewrite this comment as it defeats the purpose of assigning somebody the review responsibility.

The above are Amit's comments to my draft issue (see by 12 of this no	tebook). These
comments were forwarded to me by Asad at our meeting of March 6pm, Based on these comments, I researched this issue further,	8,2002. armal
6 pm, Based on these comments I researched this issue further.	DAD 3/8/2002
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Project No .__ TITLE DUE Surface Fire Hayard Analys. BOOK NO. 504 Estimate of Diesel Fuel Needed to Sustain a 10 CFR 71.73 Hypethetical Accident Conditions Fire From Page No Required Fire Temperature & Duration and Size: (Fm. # 10 CFR 71.73) · Average flame temperature of 800°C for a period of 30 minutes · Fuel Source must extend honzontally at least Im (40") beyond the external surfice of the specimen. METHOD 1: From HI-STORM TSAR Report HI-951312 we have, (Pg 11.2-10) 50 gallons of fuel will burn in 3.622 minutes. 50 get diesel fuel pool: Based on the 50 gallon fuel volume, the overpack outer diameter and the 1 m fuel ring width, the fuel ring surrounding the overpack covers 147.6 ft² and has a depth of 0.54 in. From this depth and a linear fuel consumption rate of 0.15 in/min, the fire duration is calculated to be 3.622 minutes (217 seconds). The linear fuel consumption rate of 0.15 in/min is the smallest value given in a Sandia Report on large pool fire thermal testing [11.2.2]. Use of the minimum linear consumption rate conservatively maximizes the duration of the fire. Fuel Consumption Rate = (50 gal) = 13.81 gal/ 1 (3.622 min) = 13.81 gal/ min = 14 gel/n : Fuel required to Sustain IOCFR 71.73 fire = (14 gpm x 30 min) = 420 gab need > 420 gal of diesel fuel to damage trinsport lust To Page No 1.SN Invented by nessed & Understood by me 3/11/02 Recorded by

Brak No. 504 HTLE DOE Suface Fire Hazard Analytis. METHOD 2: To gain confidence in the result from Method 2 on py 17 of this notebook, a second calculation was made. From HI-STORM TSAR Report HI-951312 (Py 4.5-4) we have: for the HI-TRACK cask, the dimensions are: Height of HI-TRACK = 14 ft De Diameter " ~ ~ 7.6 ft.

Turbulent natural convection correlations are suitable for use when the product of the Grashof and Prandtl (Gr×Pr) numbers exceeds 10⁹. This product can be expressed as $L^3 \times \Delta T \times Z$, where L is the characteristic length, ΔT is the surface-to-ambient temperature difference, and Z is a function of the surface temperature. The characteristic length of a vertically oriented HI-TRAC is its height of approximately 17 feet. The value of Z, conservatively taken at a surface temperature of 340°F, is 2.6×10^5 . Solving for the value of ΔT that satisfies the equivalence $L^3 \times \Delta T \times Z = 10^9$ yields $\Delta T = 0.78^{\circ}$ F. For a horizontally oriented HI-TRAC the characteristic length is the diameter of approximately 7.6 feet (minimum of 100- and 125-ton designs), yielding $\Delta T = 8.76^{\circ}$ F. The natural convection will be turbulent, therefore, provided the surface to air temperature difference is greater than or equal to 0.78°F for a vertical orientation and 8.76°F for a horizontal orientation.

HI-TRACK Cusk DND 3/11/6

Project No .__ DOE Surface Fire Hoyard Analyers. Book No. 504 From Page No From 10 CFR 71.73, for Hypothetical Accident Case fine, we have a requirement that the finel source must extend wayoutally at least Im (40") beyond the external surface of the cash (see Pg 14 of this notebook) We can therefore calculate the required surface area of the diesel fuel pool needed to satisfy this, requirement as follows: Cash Area = (17 ft x 7.6 ft-) = 129-2 ft2 (In horizontal Orientation) If diesel pool extends Im (40") beyond cash, then Diesel Pool Area = ((17+3.3) ft x (7.6+3.3) ft)= (20'x 11' > = 220 ft2 From NFPA 92B Table B.S. 2 (a) "Unit Heat Release Rate for Commodities" (2000 edition) we have: Heat Release Rate for Diesel Oil = 175 Btu/secft2 Heat Release Rate from Diesel Fuel Pool = (195 BTU × 220 ft) Sec.ft = 38,500 BTU = 2.31×106 BTU Sec _____ min Diesel Fuel = 19,400 BTU (WVNS FHA Pg 31) WUNS FHA 8.04 16 Diesel Fuel Density = (1608 165) = Pg 31) Deles 3/1 To Page No Date Invented by Witnessed & Understood by me, Date Recorded by

Project No. Book No. <u>504</u> TITLE DOE Surface Fire Hayard Analysis n Page No : Diesel Fuel Pool Burn Rate => (2.31×10⁶ - BTT × Ho × gal min 19,400 BTT 8.04 1/5 : Fuel Consumption Rate from 220 ft 2 pool = 14.81 gpm : Fuel required to Sustain IOCFR 71.73 fire = (14.8 gpm × 30 min) = 444 gals. This result agrees well with result from Method I on page 17 of this note book. ". You need > 450 gallons of diesel fuel to damage transport cashs from fine AAD 3/12/02 To Page No Recorded by

Project No.____ TITLE DOE Suface Fire Hozard Analysis 21 Book No. 504 From Page No. The Waste Handling Blody Carrier Bay may have 3/28/02 2 prime movers and one 20ton farhlift (from Pg 12 of this notebook). Further, a Rail Site 441 Prime Move has a capacity of 290 tons. (from I this note book . Pg 15 of this Lote book). Estimation of Diesel Fuel Inventory in WHI-Carrier Bay with 2 site Prime Moves + Forhlift WHB 28 ales on pg I investigated several internet sites for information on the diesel fuel tank size for diesel locomotives. I found Ľ that tank sizes varied from around 600 gallons changed. (for switcher locomotives used to shunt rail cars in railway yards) to around 2000 gallons for large been Cross-country locomotives. Information from the Conclusion has web search has been pasted on the pages that follow I focused on the vail site prime mover as it had a much large capacity of 290 tons compared to the truck (48 tons). Conclusion: Using the 600 gall tank capacity (smallest) for each site prime would, you can easily exceed the 450 gallon H; Note, requirement for dissel fuel given on pg 20 of this hotobook, and Can damage Fransport cark from fine. 22/3-14-02 To Page No. Vitnessed & Understood by me, Date Invented by Date Witnessed & Understood by me, Recorded by

Project	NO
Book	No. 504

TITLE DOE Sufare Fire Hazard Analysis

Sum Page No.

Darius Daruwalla

From:	gelwood [gelwood@dnaco.net]
Sent:	Thursday, March 14, 2002 1:00 PM
To:	Darius Daruwalla
Subject:	Re: Typical Diesel Fuel Tank Size

The typical fuel tank for a switcher is 600 gals. This could last several days depending on how high the engines is operating.

Many industrial railroads are getting older road switchers. These are higher horsepower (1500- 1800 HP) and have a larger fuel tanks, approx 1500 gals. This should last about a week, again depending on how high the engine is required to run. The speed of the diesel engine depends on the weight of the cars being moved.x

George Elwood http://www.dnaco.net/~gelwood

On Thu, 14 Mar 2002, Darius Daruwalla wrote:

> Hi,

>

> I have read with intwerest your impressive list of BLW switcher operator > manuals at your website.

> I am interested in information on the average size for the fuel tank of a
> diesel locomotive to be used to haul a 300 ton rail carrier to and from
> locations within an industrial site. I am researching this in connection
> with the fire potential of the fuel. Any information you may be able to
> provide would be greatly appreciated. Perhaps you may be able to point me
> to an industry standard reference where this information may be available.
>

> Thanks in advance for your help.
>

> Darius Daruwalla > Senior Research Engineer > CNWRA > Southwest Research Institute > 6220, Culebra Road, San Antonio, TX 78238 > (210) 522-3297 > (210) 522-6081 (fax)

> ddaruwalla@swri.org

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TIME DOE Sufere Fire Hizerd Analysis Book NO. 504

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wysiwyg://20/http://www.howstuffworks.com/diesel-locomotive3.ht

Information potentially subject to copyright protection was redacted from this location. The redacted material is from the website listed above regarding fuel tank specifications.

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240 3/14/02

10 No.

Project No._ Book No. 504 TITLE DOE Suface Fine Hugard Analysis. 24 n Page No Explore Adequary of the WHB Control Rm. Design Functions: The control Room will be used to: (1) Monitar operations and status of the Local Centrol Centers (i.e. Consoles in operating Galleries), and (2) Provide Emergency reponse to local off-normal events. (Engineering Files for Site Recommendation Rev 00 May 2000; Attachment I Section 1.1.11 pgs 67-69 Further, the control room is identified as H-119 in WHB/WTB Space Program Analysis for Site Recommendation (Lev 00, 5/12/00; Section 6.2.2. 12) Consequence: Therefore, if centrol Room istops functioning due to five you lose: i) Capability to monitor status of LCCs. 2) Provide Emergency Response to local # off-normal evente Regulations: 10 (FR 63. 112(e) (10) states that you must have: means to permit prompt termination of operations. during emergency. MAS/19/D2 To Page NO. Witnessed & Understood by me. Date Invented by Date Recorded by

DOE Sufare Fire Hozard Analysis Book No. 504 25 Engineering Files for Site Recommendation, Rev 00, May 2010 From Page No. Indicates that there will be a WHB Central Cintrol Center (CCC); a CCC in the computer center in Administration Building; and Local Central Centers (LCC The primary control functions of waste handling operations will be handled from the operating galleries (LCC) where oprators will have direct line of sight of the operations In emergency response situations, control of Safety systems normally operated from LCC may be transferred to WHB CCC. In addition, a cec will the ccc in the Admin. Blog will also provide monitoring and limited emergency control functions for the WHB. may be Finally, a redundant emergency panel provided in the WHB to provide a back up control center for the WHB ccc. This Control pinel will provide emergency operations control for operations normal by the WHB CCC provided 222 3/19/02 To Page No. Date Invented by Witnessed & Understood by me, Date Recorded by

Project No.____ TITLE DOE Surface Fire Hoyard Analysis. 26 Book No. 504 From Page No Conclusions: If the final DOE design does indeed provide the Capabilities for emergency control from multiple locations as described on 1225 of this notebook, then the appears to be enough redundany and defence-in-depth features to safely handle fire situations in any of the various control locations. Control Room Designs need to be carefully tracked as the DOE design matures to ensure that the redunancy and defense - in - depth. features are preserved. It is also important to study the design details regarding interlocks between controls from the various locations. (i.e. The interlocks should preclude the capability of controling an operation simultaneously from 2 locations.). Finally the DOE should clearly identify these control room locations in their fire hazard data sheets in their final design. This is not the case at present, DOE has lumped WHB (cc Room # H-119 to getter with 33 other Spaces in their fire data sheet (page I-9 of Fire WHB Fire Hayards Technical Report, Ang 16, 1989) N.N.D 3/22/02 To Page No. Witnessed & Understood by me. Date invented by Date

From Page No. In formation on Fuel Tank Capacity for 20 Ton Firk lift-7 http://www.hyster.com/products/ice_pneumatic.ac ny - The Industry Leader in Lift Tracks - Products 20 40,000 lbs. **Information potentially** subject to copyright protection was redacted from H 360H = 32 gal diesel. Also available in LP Gas (Mald H 360) Not available in Gradience Max Electric Forklift = 8000 16 this location. The redacted material was from the website Information on 20 ton firlelift. Got from Parts dept. of Hyster in Sm Antonio during a tel. concernation. listed above containing forklift specifications. 22) 3/22 To Page No. Date Witnessed & Understood by me. Date invented by Recorded by

Project No.____ Book No.<u>504</u> 28 TITLE Possible damage to Transport Cask from Diesel Fuel Fire From Page No In Carrier Bay of Waste Handby Blog or in the Cam'r Prep. Bldg. Modifications to Method 2 Calenlations: (pg. 18 to 20 of this mite book) The calculations carried out to estimate the volume of diesel fuel needed to damage the transport cash from fire on pages 18 to 20 of this note brock were modified to get a more accurate estimate. From CRWMS MOD Report titled Repository Surface Design Engineering files Report dated June-10-1999 (BC B00000 01717-5705-00009, Rev. 03) we have: Maximum Length of Rail Trinsport lask = 230 inches (19.2ft) Max. Cross Section of Rail Transport Cash = 103 inches (8.6 ft) (NOTE: Only Max. Dimensions are given) Rerefore, if the cliesel fuel pool is to extend horizontally 1 meter be youd the external surface of the transport case; SID 3/25/02 TO Fage NO. Date Witnessed & Understood by me. Date Invented by Recorded by

LINE CONTRACT OF ANTONIO CONTRACTOR OF ANTONIO CONTRACTOR OF A CONTRACTOR OF A CONTRACTOR Project No._ Book No. 504 29 TITLE From Page No. (19·2+6·6) x (8.6+6. = 392.)iesel Pool area = a 14 222 92 Table Plate Release Diesel ea Sec diesel fuel له له UF. Rel. Rate hom ŗ, Bru X 10 6 RTU 2 min 1 SAL Fuel Pool Burn Rate 4120,000 BTU Diecel = 400 26.4 gpm 10 CFR 71.73 fire = (26.5 gpm x 30 min) fu to required ai = 794, gallon of diesel damage the lume to vo sportgallons ine 800 ge than that is ima 6 wi Tea Fotally note Dook 17'8 this This nol Uneppe 222 28/02 To Page No. Invented by Date Witnessed & Understood by me, Date **Recorded by**

11.54. Project No._ Book No. 504 30 TITLE From Page No. HT-STORM Repor calculation renced SAR based on the minimum, fuel consumption 2 This results in an estimated note book minimum volume. this page Calci im on allowable dimen maximum Cas Tris results estimated maximum vol conservative result from Method Using more Shown on pg 29 of this note book, the capacity 5 rail site prime of the have mover than ~ 800 gallons to pose a to potentia to the Transport Cask Since from nge Capacities is I Tan estim 500 gallons 600 Switt locomotiv of this notebook Pj 22 damage of a Tra sport cash may be possible: SAD 3 \$ 9/02 To Page No. due to diesel fuel fire Witnessed & Understood by me, Date Invented by Date Recorded by I have reviewed this scientific intebook and fi litan 1.1.1.2.1.1.5.1.5.5 agreement with SAP-001 4-15-05