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# Development of Authorized Limits for Portsmouth Oil Inventory Disposition



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# PORTS Oil Disposition Problem in Late 2007

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- Need to the dispose of approximately 2.5 million pounds or 350,000 gallons of lubricating oils contained in storage tanks and associated lines and process equipment.
- Need to remove oil inventory from Process Buildings prior to start of D&D.



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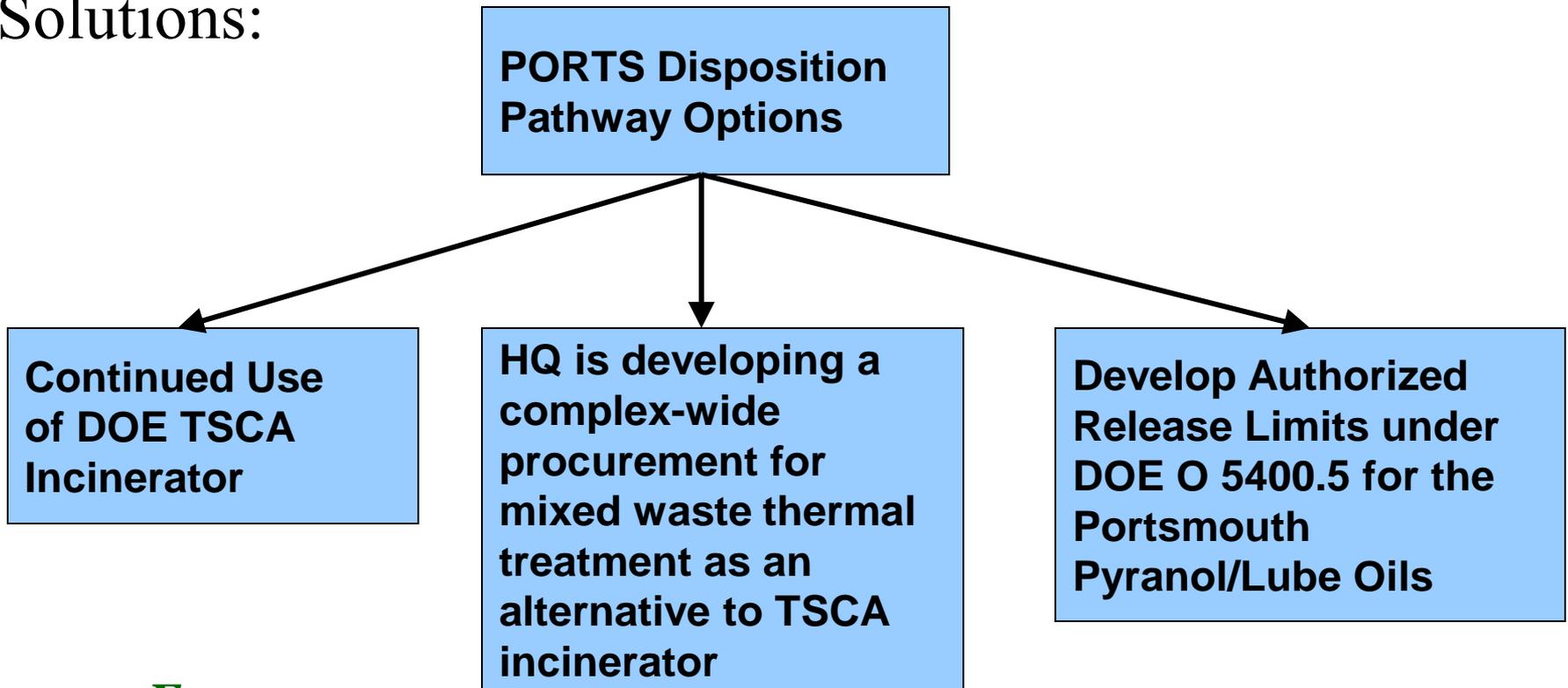
# PORTS Oil Disposition Problem Possible Solutions

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## Objective:

Remove oil inventory from Process Buildings prior to start of D&D.

## Solutions:



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# Problems With Some Potential Solutions

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## Continued Use of DOE TSCA Incinerator (TSCAI)

- The risk of equipment failure and unplanned downtime will continue to be high.
- The risk of not completing treatment of burn plan wastes will remain high, due to the age and condition of the facility.

## Headquarters' Procurement

- HQ was developing a complex-wide procurement for mixed waste thermal treatment as an alternative to TSCA incinerator.
  - There will be continued need for PCB mixed waste thermal treatment after shutdown of TSCA incinerator.
  - Based on current mixed waste broad-spectrum treatment contract pricing, commercial treatment may cost \$10 - \$100/lb for high concentration PCB mixed waste.
- At that time, the time frame yet to be determined for procurement.



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# Benefits of Using Authorized Limits Process

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- Obtaining authorized release limits for the Portsmouth Pyranol<sup>a</sup>/Lube Oil would:
  - Allow treatment of the current Portsmouth Pyranol and Lube Oil at a non-licensed commercial facility at a lower cost than TSCA incinerator.
  - Allow shutdown of TSCAI 1-2 years earlier than planned, resulting in life-cycle cost savings of \$17M - \$34M

<sup>a</sup> Pyranol in a dielectric fluid used in transformers.



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# Contaminants in Oils

Radionuclide	Concentration (pCi/g)	Laboratory Qualifier
Total Alpha	8.26E-01 ± 2.24E-01	
Total Beta	7.84E-01 ± 2.61E-01	
<sup>233/234</sup> U	2.720E-01 ± 6.335E-02	
<sup>233</sup> U wt. %	(2)	
<sup>235</sup> U	3.048E-02	U
<sup>235</sup> U wt. %	(3)	
<sup>238</sup> U	2.446E-01 ± 5.726E-02	
<sup>99</sup> Tc	3.460E-01	U
<sup>237</sup> Np	4.100E-02	U
<sup>238</sup> Pu	2.796E-02	U
<sup>239/240</sup> Pu	2.796E-02	U
<sup>241</sup> Am	9.828E-03	U
Uranium	7.30E-01 µg/ml	



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## If using ALs

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- Evaluate TSD workers dose.
- Evaluate landfill worker dose.
- Evaluate future landfill uses and possible doses
- Evaluate population doses.
- Evaluate potential future groundwater cleanup due to migration from landfill.
- Evaluate potential cleanup of landfill.



# Commercial TSDF Workers

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- Hypothetical workers.
  - Waste transportation worker
  - Waste receiving and sampling workers
  - Storage before waste processing
  - Incineration worker
  - Landfill workers
- TSD-DOSE computer code used to calculate dose.



# TSD-DOSE Estimates of Radiation Dose to TSDF Workers

TSDF Worker Scenario	Estimated Radiation Dose
Waste Transportation Worker	3.5E-03 mrem
Waste Receiving Worker	1.1E-02 mrem
Incineration Worker	1.0E-02 mrem
Landfill Worker	2.6E-03 mrem

- Assumes hypothetical TSDF worker directly participates in the disposal of the entire annual volume.
- Assumes shipment in 55 gallon drums, but likely shipped in bulk containers (less handling).
- Assumes entire waste volume contains the radionuclides of concern at the maximum detected concentration.
- Assuming entire volume was incinerated in one year, estimates are below the primary DOE dose constraint of 25 mrem/year.



# Exposure after Disposal of Ash

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- Estimates of dose to hypothetical future receptors at a landfill where the residual waste following incineration of the lubricating oil waste stream is disposed were evaluated using the RESRAD computer code.
- Performed analysis for exposure to
  - hypothetical landfill where incinerator ash and secondary wastes may be disposed.
  - hypothetical resident occupies the disposal site, beginning 30 years following closure.
  - hypothetical resident farmer is assumed to occupy the site, beginning 100 years after closure.



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# Future Receptor Doses

Scenario (Receptor)	Estimated Dose to Future Receptor (mrem/yr)
Future Worker <sup>a</sup>	3.7E-04
Future Resident <sup>b</sup>	7.8E-03
Future Subsistence Farmer <sup>c</sup>	7.0E-01

<sup>a</sup> Dose constraint of 1 mrem/yr for 0 to 1000 years post closure.

<sup>b</sup> Dose constraint of 25 mrem/yr with ALARA goal of 15 mrem/yr for 30 to 1000 years post closure.

<sup>c</sup> Dose constraint of 25 mrem/yr with ALARA goal of 15 mrem/yr for 100 to 1000 years post closure.



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# Individual and Collective Public Dose

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- Including workers and the off-site public for collective dose.
- Time-integrated population dose during facility operations and 100 years post closure.
- Since the residual wastes following treatment would be contained in an engineered disposal cell constructed to meet the requirements of applicable state and federal solid waste management regulations, most potential exposure pathways would be significantly restricted or eliminated.
- Only external radiation, radon migration through the cap and cover system, and exposure to radioactive materials in leachate would be plausible active exposure pathways.
- Even in the unlikely case of an intruder who might excavate into the waste, the dose would be small, particularly in light of the mixing of this small volume of waste with the overlying cover materials and surrounding waste that would occur during excavation.



# Calculated Doses to the Public

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- The potential radiation dose from commercial treatment and disposal of the proposed waste stream is estimated at approximately 0.01 mrem/year to a hypothetical maximally exposed worker at the commercial waste treatment facility and approximately  $2\text{E-}4$  mrem/year to the maximally exposed member of the off-site public.
- The collective population dose (workers and off-site public) is estimated at less than  $5\text{E-}4$  person-rem.



# Other Impacts Evaluated

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- No detrimental impacts to groundwater quality would be expected to result from the commercial disposal of this waste stream,
- No requirement for future remediation be expected to result from the disposal of this waste,
  - for the incineration facility
  - for a landfill where incinerator ash may be disposed.



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# Costs Analysis

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- Commercial non-licensed treatment of large volumes with very low radioactivity (authorized release): \$0.50/lb
- Current TSCA incinerator cost (dependent on throughput ranging from 1.5 to 4 million pounds per year): \$4 - \$11/lb
- Current broad-spectrum treatment cost for non-PCB mixed waste: \$10 - \$20/lb, depending on contaminants
- Potential commercial mixed waste treatment cost for high-concentration PCB mixed waste: \$10 - \$100/lb (based on current broad spectrum contract pricing adjusted for PCB concentrations from 16,000 ppm to 650,000 ppm); lower PCB concentrations would be treated at non-PCB cost.



# Collaboration with non-DOE Entities

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- Received concurrence from two commercial incinerator who were willing and able to receive the waste.
- Received concurrence from Texas Commission of Environmental Quality



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# Authorized Clearance Levels for Radiological Inventory in X-330 & X-333 PCB Dielectric Fluid

Radionuclide	Assumed Activity Concentration <sup>b</sup> (pCi/g)	Total Activity Inventory <sup>c</sup> (Ci)
<sup>233/234</sup> U	2.7E-01	3.1E-04
<sup>235</sup> U <sup>a</sup>	1.1E-02	1.3E-05
<sup>238</sup> U <sup>a</sup>	2.7E-01	3.1E-04

<sup>a</sup> Radionuclide analyzed for but not detected above instrument quantification level for this waste matrix. Conservatively assumed to be present in secular equilibrium with <sup>233/234</sup>U which was the only analyte detected above instrument quantification levels.

<sup>b</sup> Assumes isotopic abundance of 2% enriched uranium (~49% each <sup>234</sup>U and <sup>238</sup>U, 2% <sup>235</sup>U).

<sup>c</sup> Based on total waste inventory of 1.2 million kg or 350,000 gallons (specific gravity 0.8796).



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# Authorized Release under DOE O 5400.5

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- HS-20 performed a review of the final draft reports and returned favorable comments.
- Authorized Limits was approved by PPPO Manager 12/17/2008.
- Release of Portsmouth Pyranol and Lube Oil inventories under DOE O 5400.5 met the following objectives:
  - Cost effective for DOE because it allows for early closure of TSACI creating a \$17 M to \$34 M dollar cost avoidance.
  - Disposition was completed prior to D&D.



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# Other Authorized Limits Applications at PPPO

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- Release of Residual Radioactive Waste for disposal at C-746-U Landfill.
- Release of Calcium Fluoride waste at the Depleted Uranium Hexafluoride Plant at Portsmouth and Paducah.
- Release of Hydrofluoric acid product at the Deplete Uranium Hexafluoride Plant at Portsmouth and Paducah.
- Release of DOE Owned Property Outside the Limited Area at Paducah (for real property, in development).
- Release of Trichloroethylene with Residual  $^{99}\text{Tc}$  for incineration (in development).



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# Questions?

For further information, please contact Don Dihel at 270-441-6824 or Dan Mosley at 740-897-2856.



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