

Materials management in nuclear
decommissioning – challenges and opportunities
25 May 2010, Manchester



Automated and intelligent waste segregation technologies – the US experience



Featuring Scanning Spectroscopy Technology

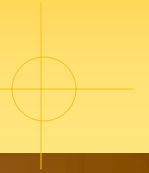
Waste hierarchy



- Avoid...producing LLW
- Minimise...amount of LLW produced
- Recycle/re-use ...materials which may otherwise be consigned as LLW

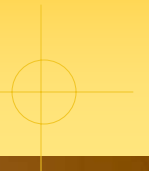
- Divert exempt waste away from LLWR
- Agree exempt limits and averaging volumes with regulators

Sustainable LLW disposal?



- LLW inventory 3 million m³ (2008 – 2129)
- LLWR capacity ~ 0.7 million m³ scheduled in LTP
- 40% is LLW, 60% is HVVLLW
- 33% of LLW is soil & rubble
- 63% of VLLW is soil & rubble
- So over 50% of projected LLW inventory is suitable for application of waste segregation technology

How Does it Work?



- MACTEC's *ORION*SM Radiological Soil Sorting Survey System uses
 - Large volume spectroscopy grade solid-state detectors
 - MACTEC's advanced Scanning Spectrometer software, *SPARTAN*SM
- Detects gamma-emitting radionuclides as the soil on the belt moves past the active area of the detector

How Does it Work?

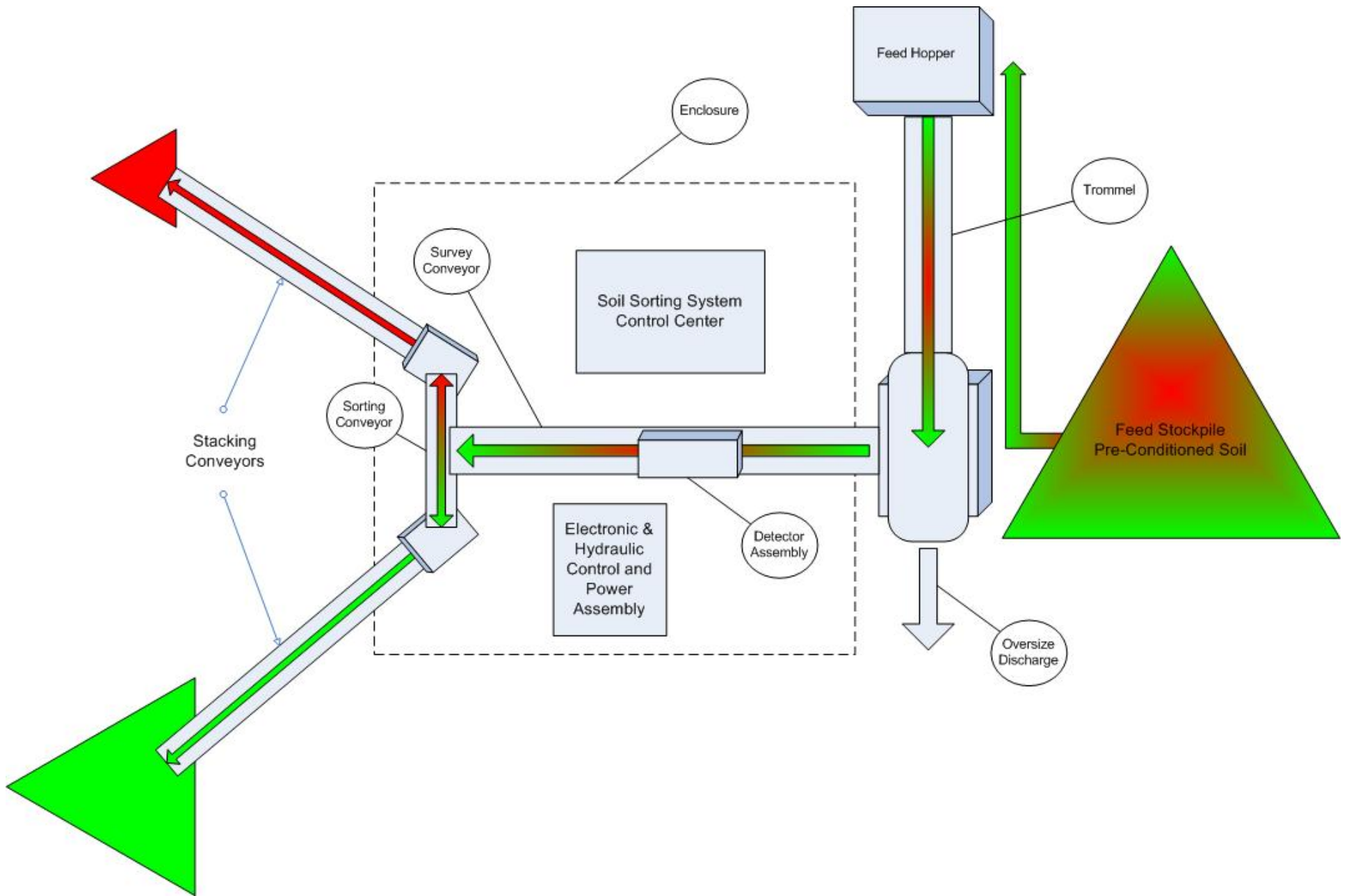


- Multiple detectors are arrayed above material conveying equipment to provide real time radiological data and material sorting.
 - A variety of material conveying equipment can be used to handle most common waste forms.
 - Supports multiple gamma spectrometers of any size
 - Up to 12 auxiliary detectors (radiological or otherwise) provide additional material characterization and control

How Does it Work?



- Additional inputs/outputs help manage the process
 - Belt speed, depth, density, and weight are monitored for consistency
 - Audio and visual alarms for system status
 - Control of additional material conveyors



Soil Sorting Operation at the Saxton Nuclear Power Station



How Does it Work?



- Software Automates and Controls the Measurement and Sorting Processes
 - Real time system status available over WiFi
 - Uses real-time spectral stripping to improve the signal-to-noise ratio in a region of interest
 - Monitor multiple isotopes simultaneously
 - Evaluate radiological concentrations against multiple volumes simultaneously
 - Auto-generated process summary reports
 - Automated QA measurements and reporting



 **MACTEC**

Soil Sorting Technology

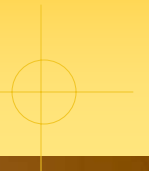


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Established Technology & Performance

- SS Series technology has been proven and accepted by:
 - U.S. Nuclear Regulatory Commission (NRC)
 - U.S. Environmental Protection Agency (EPA)
 - Various State Agencies
- Approved on-site waste acceptance
 - Reduced transportation risk exposure and waste acceptance uncertainty to site owner

Project Time Line



- Procurement Lead Time
 - Typically 30-90 days from order
- Mobilization
 - Onsite set-up, integration, and calibration typically requires a setup time of ~5 days
- Demobilization
 - Disassembly, decontamination, preparation for transportation typically requires ~5 days

Production Rate



- Dependent upon:
 - Isotopes, limits, and applicable volumes
- Example 1
 - Cs-137, 0.074 Bq/g (2 pCi/g), 900 kg monitoring volume
 - Production Rate ~90,000 kg/hr
- Example 2
 - Thorium or Uranium at 0.11 Bq/g (3 pCi/g), 900 kg monitoring volume
 - Production Rate ~90,000 kg/hr

Key Advantages

- ***ORION*SM Soil Sorting System**
 - Minimization of waste disposal costs
 - Industry leading process rates
 - Large volume detectors provide superior sensitivity
 - Isotope specific measurements
 - Spectral stripping dramatically improves accuracy
 - System

System Data Output



- MACTEC's *SPARTAN*SM Processing software generates a variety of output files, including:
 - Total run summary data
 - Summary data for each pile (diverted and normal)
 - Auto-generated summary reports for each pile to client or regulator
 - Auto-generated QA/QC
 - Client specific web page with survey reports or summaries for offsite review
 - Consolidation reports for combining multiple survey batches

Sample Data Output Record


 SS-Series Volumetric Sorting Record Radioactive Characteristic Profile	
Survey Area	Contaminated Stockpile
Survey Unit	0016
Survey Equipment	ORION M302
Survey Date	8/28/2009 6:37:36 AM to 8/28/2009 1:34:43 PM
Survey Operator	Javid Kelley
Material Surveyed	Soil
Criteria	5.2 pCi/g
Number of Measurements	7107
Total Tons Processed	499.24 (998,480lbs)
Number of Diversions	7
Total Tons Diverted	1.15 (2,305lbs) (0.23 % of Total)

Table 1. Below Criteria Volumetric Concentration Reported in pCi/g

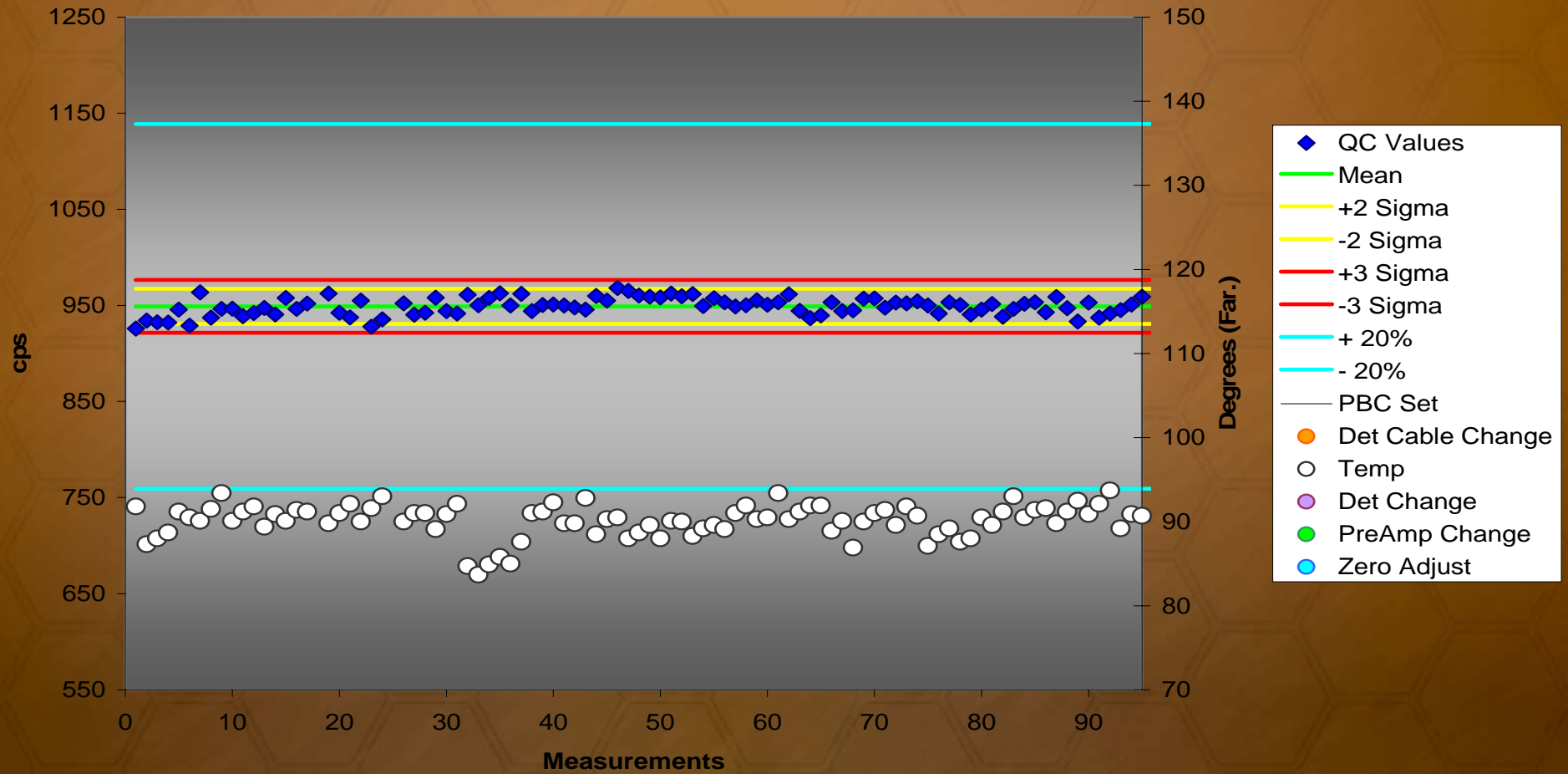
Isotope	Mean \pm 95% Confidence	Median	Maximum	Minimum	2-Sigma Population Variance
Net Cs-137	0.0 \pm 0.01	0.1	1.5	-1.5	0.7

Table 2. Diverted Volumetric Concentration Reported in pCi/g

Isotope	Mean \pm 95% Confidence	Median	Maximum	Minimum	2-Sigma Population Variance
Net Cs-137	0.1 \pm 0.05	0.1	3.0	-0.8	0.8

Sample Automated QA/QC Control Chart

Detector 4 Source Response Checks



Soil Sorting Operation at the NASA Plum Brook Reactor Facility



- Contaminant of Concern
 - Cs-137 0.2 Bq/g
- Monitoring Volume
 - 80 kg
- Production Rate
 - 145,150 kg/hr (160 tons/hr)



Soil Sorting Operation at the NASA Plum Brook Reactor Facility



■ One month into Full Production, MACTEC has sorted ~25 million kg of Soil Material



Soil Sorting Technology



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Conclusion

- MACTEC's *ORION*SM Soil Sorting System is the most technologically advanced and the most cost-effective solution for radioactive waste segregation on the market.
- MACTEC and WorleyParsons are committed to providing cost-effective solutions of the highest quality and best value.
- Our unique expertise and experience in soil screening & sorting technology enables us to provide clients with unparalleled flexibility and cost savings over a wide range of commercial, NDA, MoD, and other radiological decontamination and decommissioning challenges

Like to Know More?

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