

# Virtual Reality Technology for Radioactive Job Planning and Worker Training at Nuclear Power Plant



GENERATING SUCCESS --- FOR 100 YEARS

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# Kinectrics Corporate Overview



- The category leader in providing life cycle management solutions
- Providing advanced expertise in testing, inspection, and certification backed by over 100 years of experience in the electricity industry
- Formerly the technical division of Ontario Hydro, one of North America's largest, most reliable utilities
- Staffed by over 400 industry-leading scientists, engineers & business professionals
- Comprehensive testing, design and manufacturing facilities / specialized state-of-the art laboratories



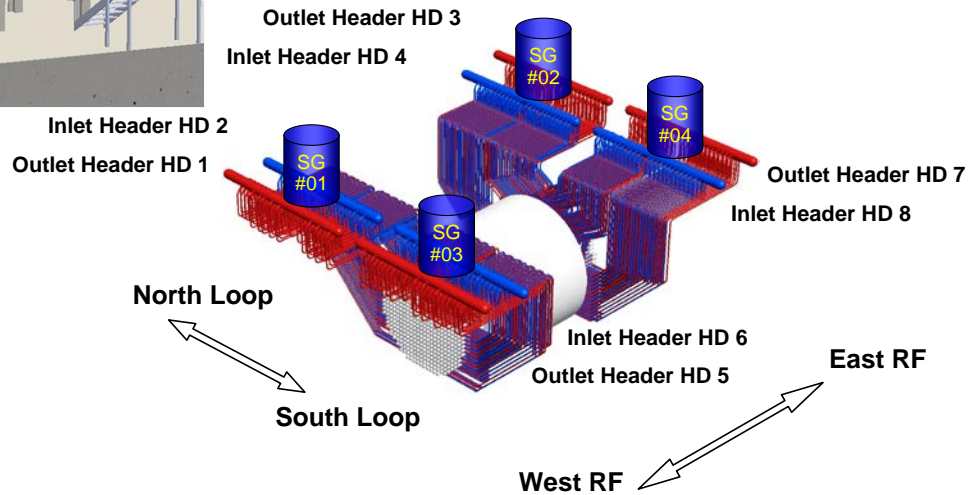
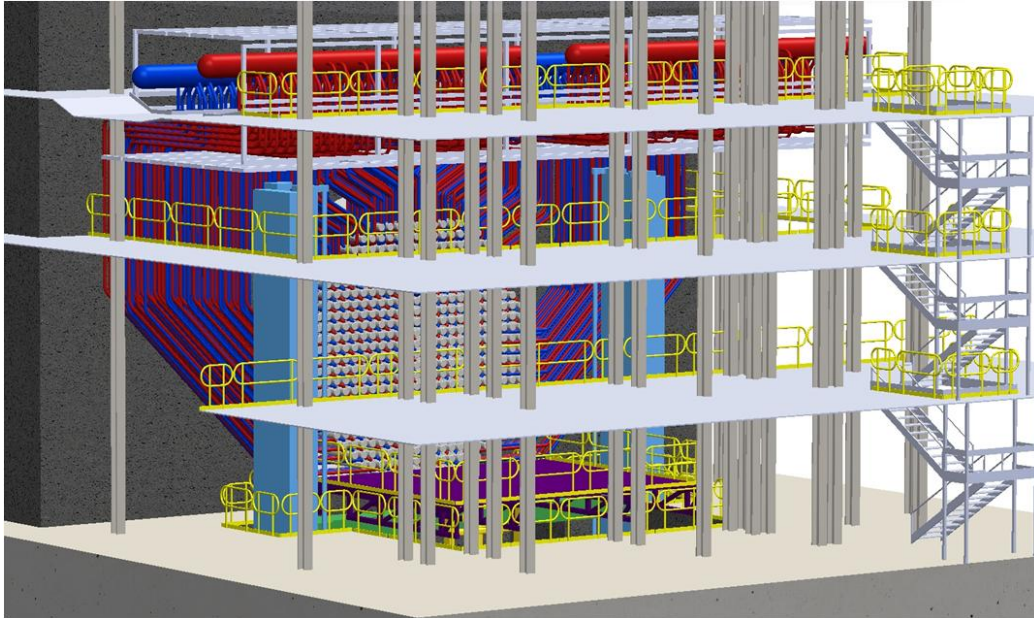
***Kinectrics has the technical expertise to provide broad-based support services for your operations***

# Discussion Points

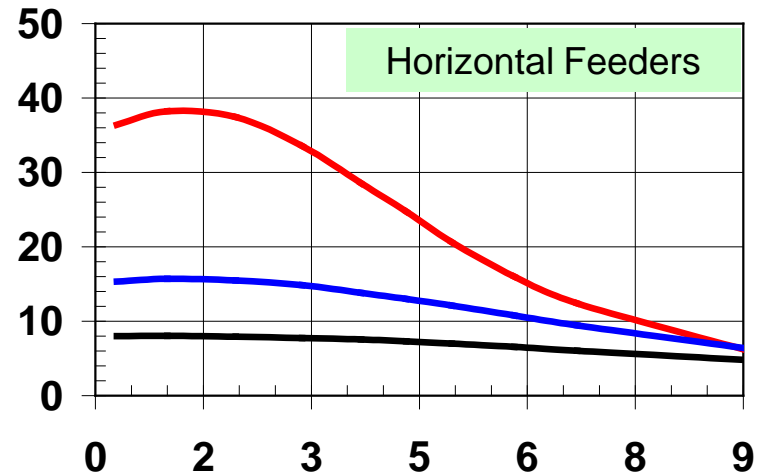
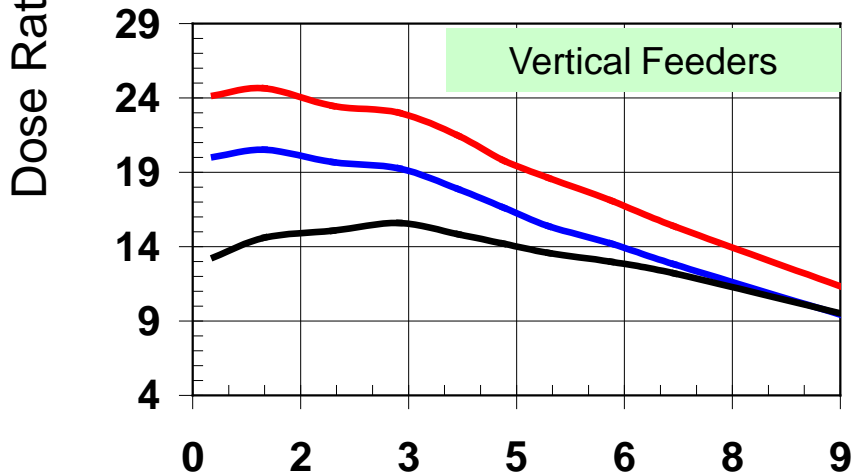
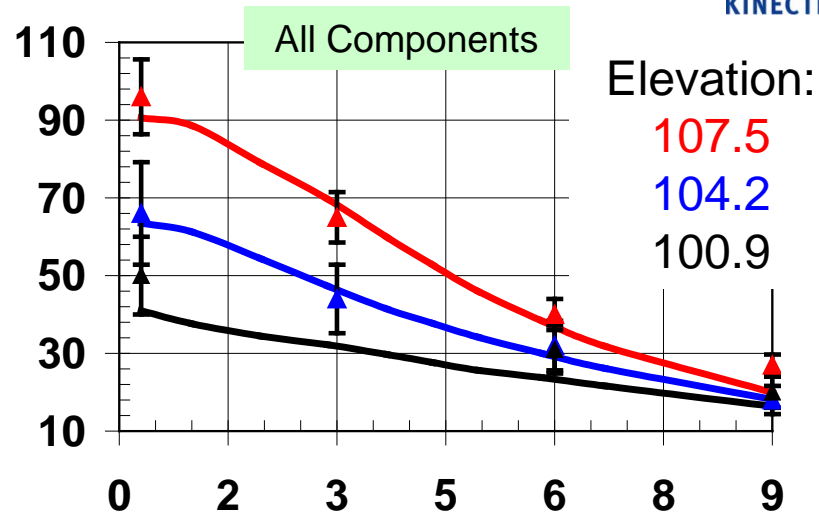
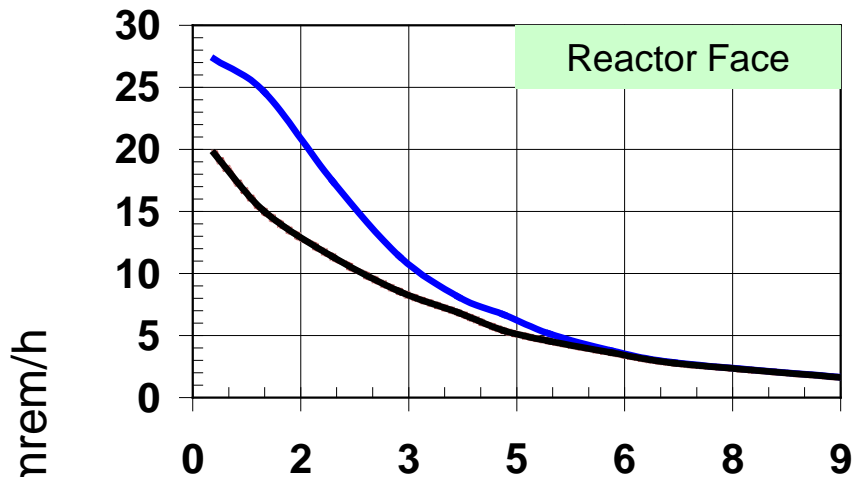


- I Outage Radiation Fields at CANDU plant
- II **A**dvanced **D**ose **E**xposure **P**lanning **T**ool (ADEPT)
- III ADEPT\_ Key Features & Benefits
- IV Application of ADEPT

# CANDU Reactor Unit

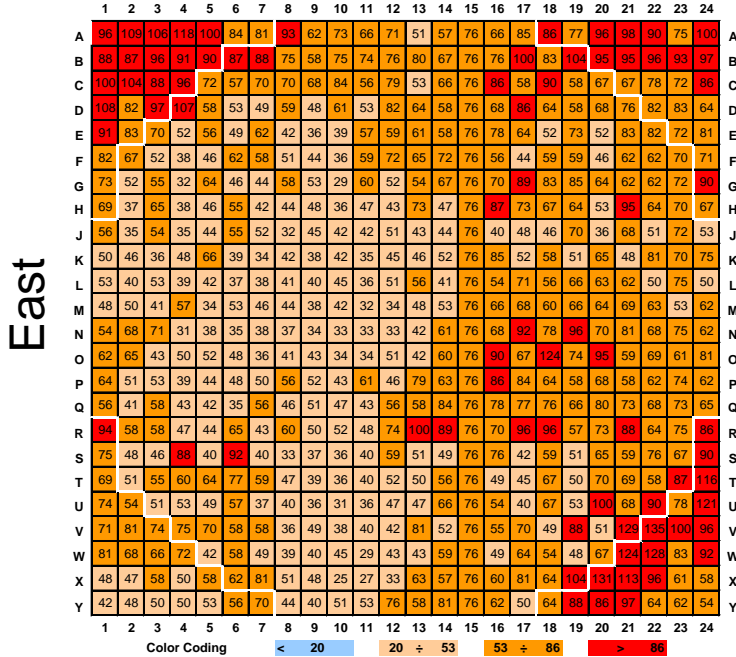


# Component Radiation Fields



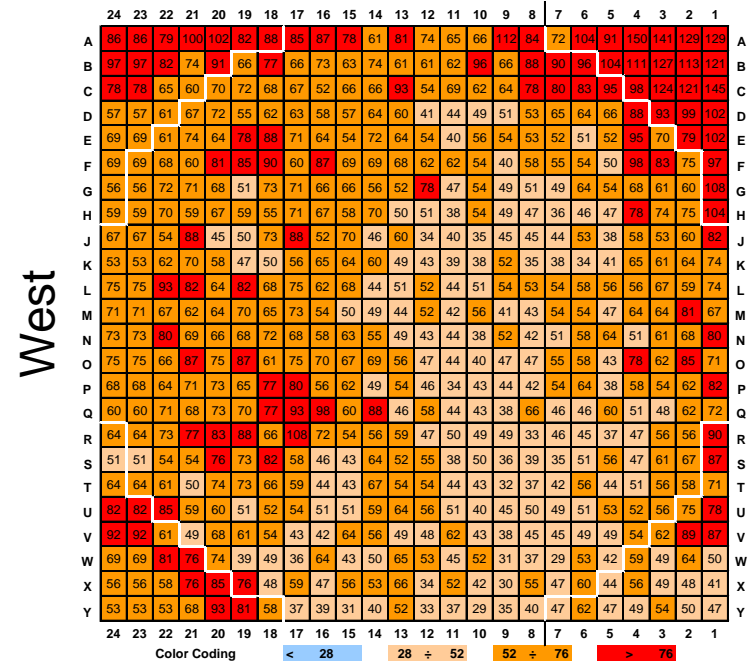
Distance from the RF, m

# Reactor Face Radiation Fields



Pale Blue  
Tan  
Orange  
Red

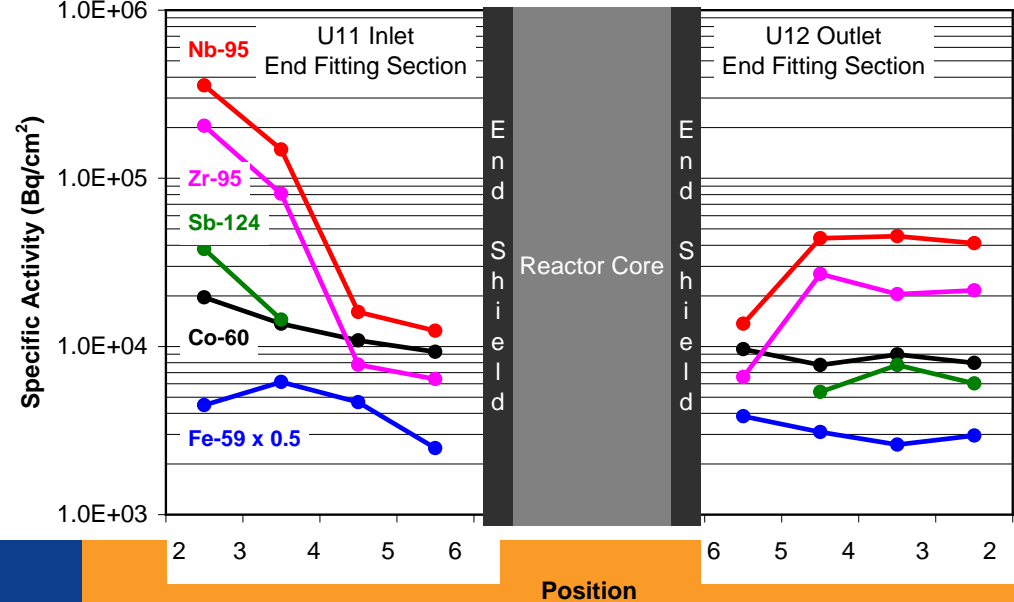
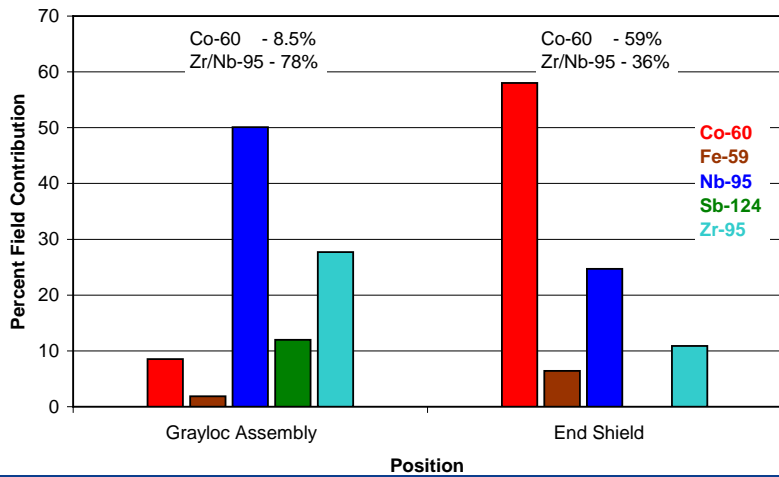
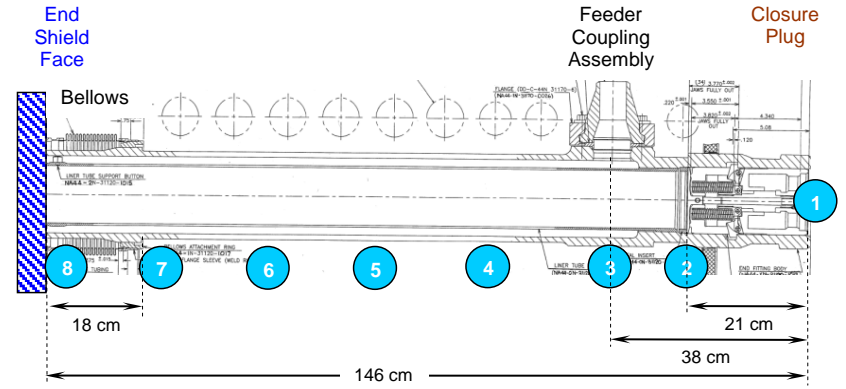
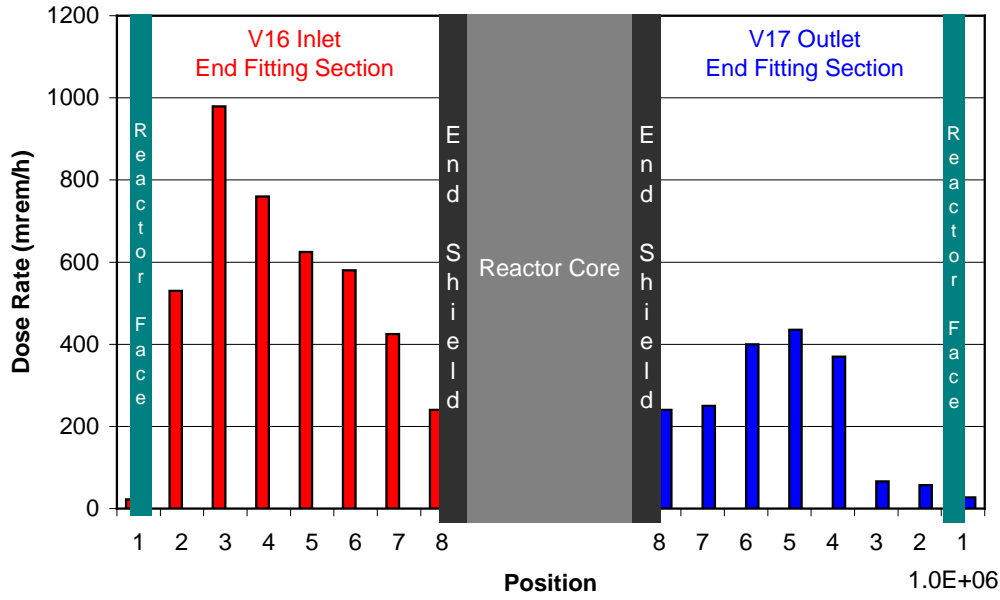
$r_i < R-3\sigma$   
 $R-3\sigma \leq r_i \leq R$   
 $R < r_i \leq R+3\sigma$   
 $r_i > R+3\sigma$



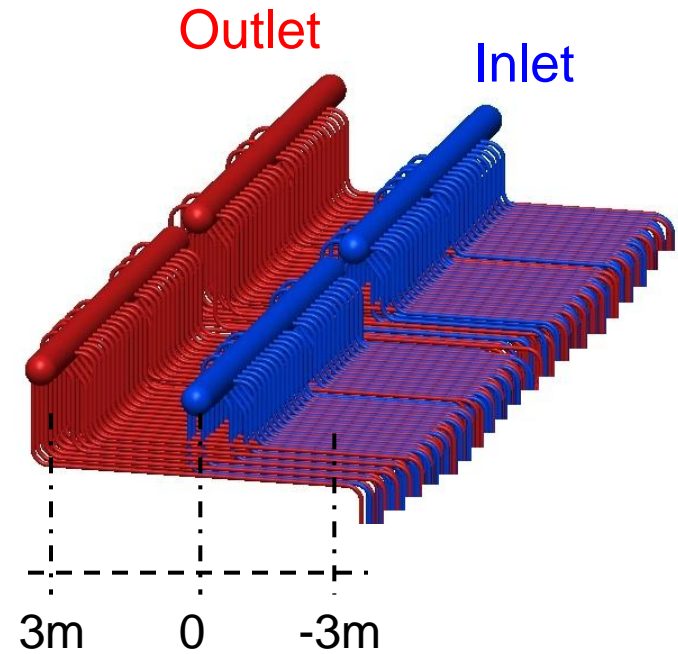
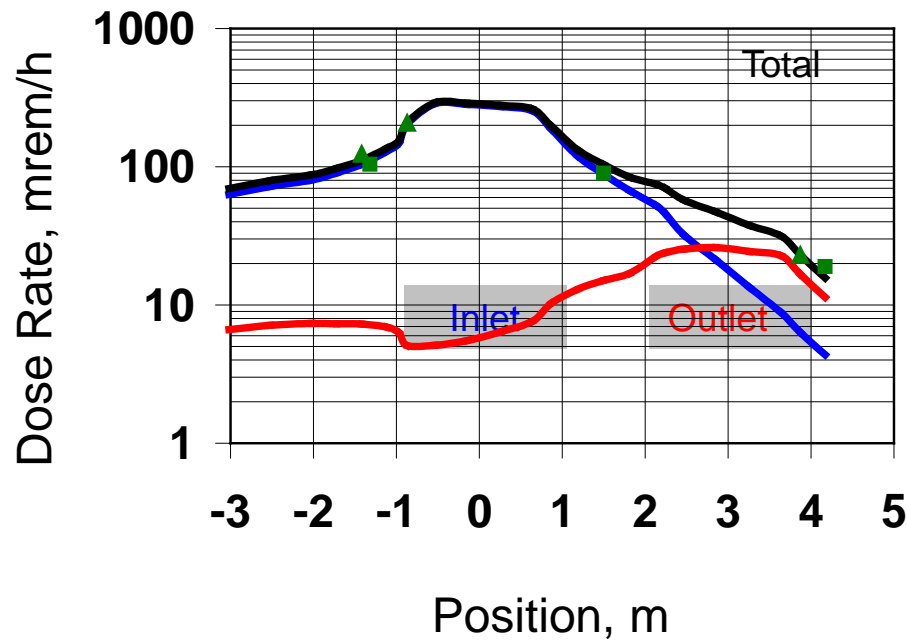
Face/Loop	North, N	South, S	N/S
West, W	<b>66 ±13</b>	<b>59 ±22</b>	<b>1.12</b>
East, E	<b>71 ±17</b>	<b>55 ±18</b>	<b>1.29</b>
Ratio W/E	<b>0.93</b>	<b>1.07</b>	



# Activity Distributions for End Fittings



# Horizontal Feeder Cabinet Fields





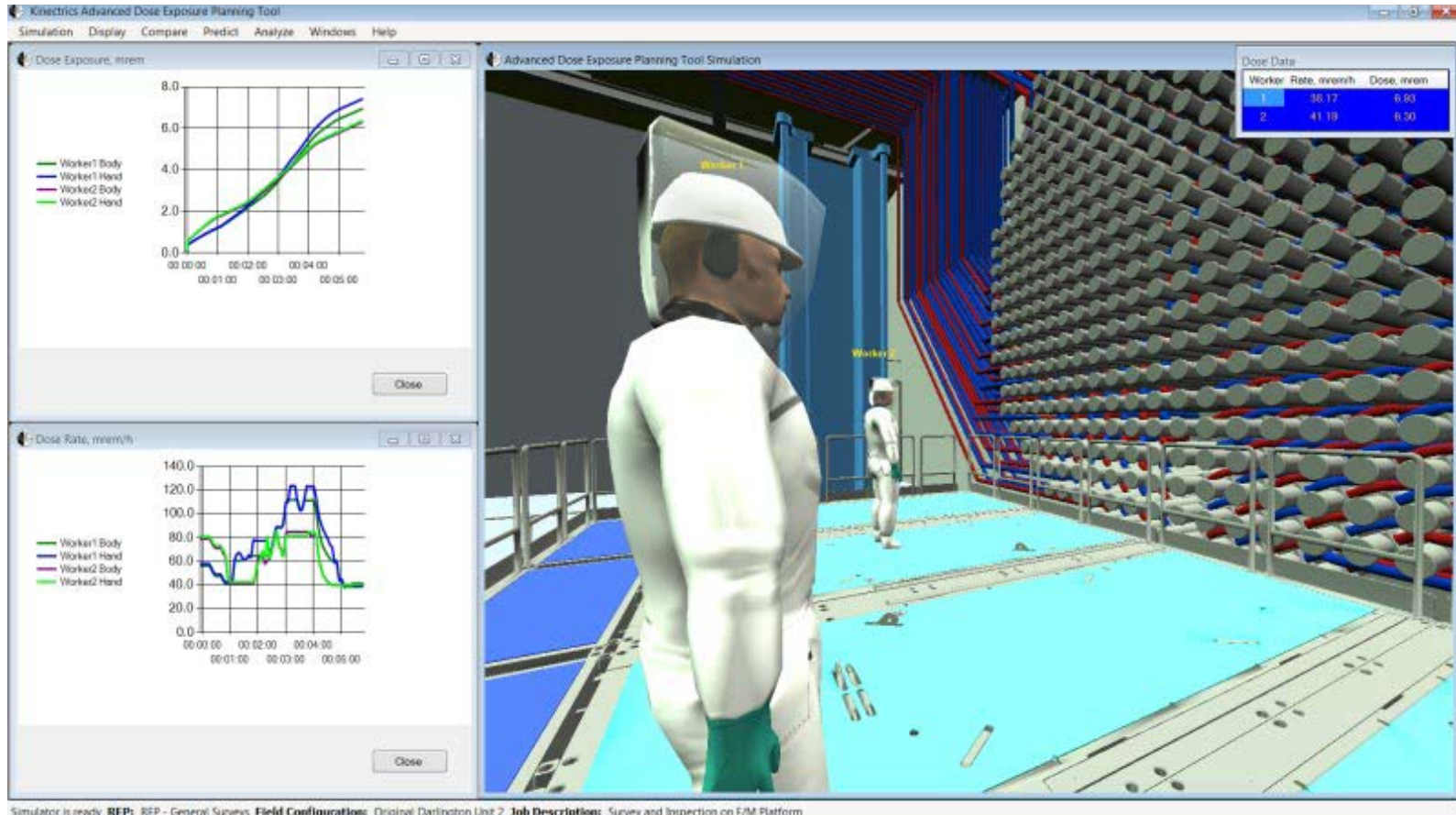
# ADEPT



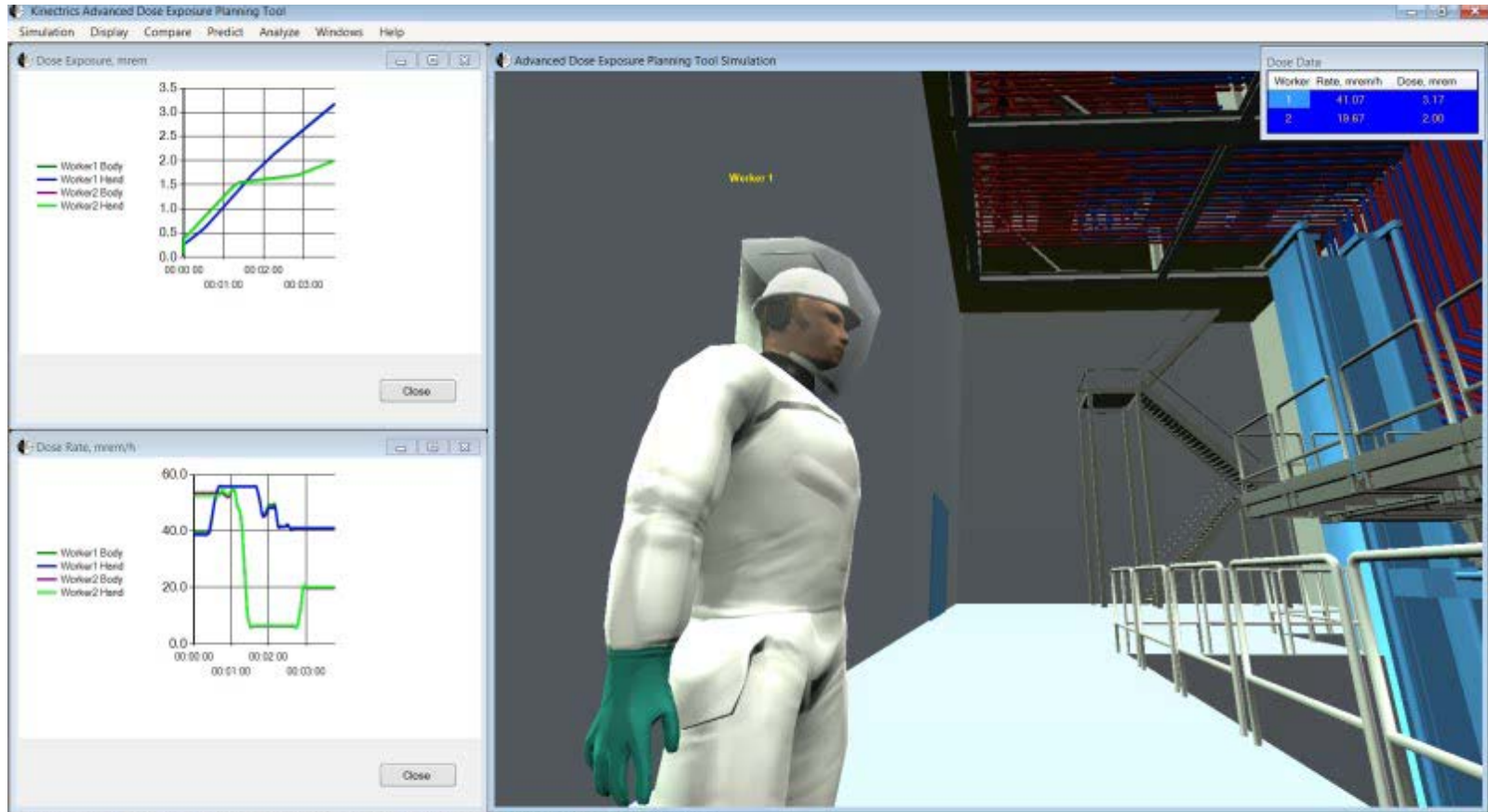
## Advanced Dose Exposure Planning Tool

- Planning and Evaluation of Radiation Protection
- Procedural Training for New and Existing Staff
- Planning of Inspection and Maintenance Activities
- Pre-job Briefings and Post-job Reviews
- Benchmarking
- Support for ALARA Initiatives

# Job Simulation on F/M Platform



# Job Simulation in the Reactor Vault



# Comparison: Simulation to Station Data



## Select Configurations

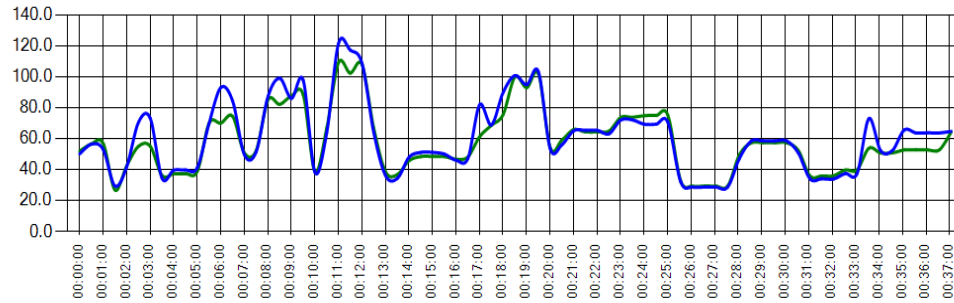
Dose reduced, mrem : 9.64

Show Doses

### Simulation

REP : REP - General Surveys  
 Field Configuration : Original Darlington Unit 2  
 Job Description : General Surveys on F/M Platform

	Body Dose, mrem	Max. Rate, mrem/h
Worker 1	35.74	108.95

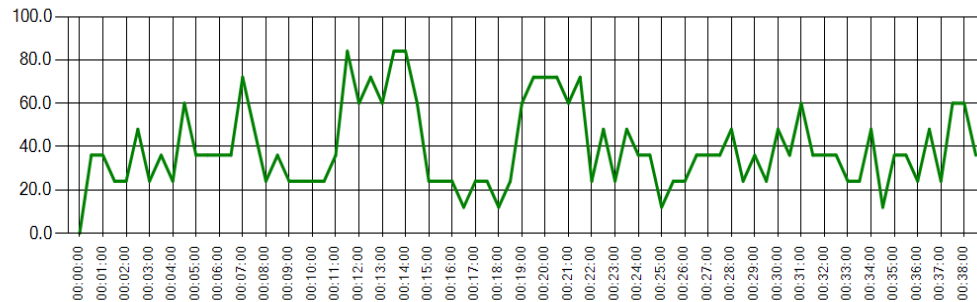


Total for simulation: 35.74

### Station Data

REP : 15019  
 DISN : 449487  
 Start Time : 07/04/2010 7:09:21 PM  
 End Time : 07/04/2010 7:48:12 PM

	Body Dose, mrem	Max. Rate, mrem/h
Worker 1	26.10	84.00



Total for Station Data: 26.10

# ADEPT – Interface



- LEAP MOTION
- OKULUS Virtual Reality



# ADEPT – Key Features



- Fully customizable real-time 3D virtual reality job simulation in a CANDU reactor environment
- Radiation field simulation based on actual OATM data
- Live display of whole body and extremity dose rates, as well as doses of simulated workers
- Recording of radioactive job procedures for future analysis
- Instant estimate of shielding option effects
- Multiple dosimeters take the accuracy of effective worker dose estimations to a new level



# ADEPT – Benefits

- Visualizes Work Environments for Staff in Great Detail
- Provides Options for Elaborate Planning to Help Reduce Worker Dose & Save Time on the Critical Path
- Enables an Opportunity to Evaluate the Impact of working in different Configurations and Scenarios
- Demonstrates the Effects of Source Term Reduction