PanoRem™
Radiation Estimating Management Tool

CSA is participating with EPRI on development of the radiation exposure estimating tool, PanoRem™, for improved radiation estimation for nuclear plant activities. PanoRem™ uses the photorealistic laser scan database to provide a 3D background for the estimation activities. The estimation process is based on the “estimating algorithm” developed by EPRI.

PanoRem (PanoMap® Radiation Estimation Manager) is a module of CSA laser scanning software, PanoMap®. The module manages radiation surveys, sources, and shielding, and radiation estimation functions.

The radiation estimation tool is based on the following concepts:

- **Typical radiation surveys** of the plant areas are performed and updated to the radiation survey plant database.

- **Radiation sources** – pipes, equipment, etc. are identified within the PanoMap® scan 3D database and provided in simplified format to the estimating tool.

- **Plant radiation shielding** is identified and converted to a simplified model format. The shielding might represent existing plant components and structures, permanent shielding in the plant, or temporary shielding placed to support construction activities.

- **Work order activities** to be performed are identified and placed into the work order database. The work task or activity is identified by activity number, description, location of each person, and duration. The location can be either stationary or represented by an activity path.
Based on the data described above, the EPRI algorithm performs the radiation estimate for each activity and person (receptor). The demonstration of the tool was performed at Kewaunee Nuclear Plant.

Collection of the Radiation Surveys

This is a very important part of the process. The PanoRem™ radiation estimating tool provides the facility to maintain radiation surveys by survey number, date, plant location, etc. The survey locations are placed as 3D locations against the laser scan database. This ensures more accurate locations of the surveys within the plant.

The Android tablet with iPanoMap® also provides support to collect the data in the field. The radiation survey technician can place the survey point using the tablet against the scan on the tablet at 3D locations. Using the tablet the surveyor can collect much more accurate field information. If the tablet is not used, the surveyor can place the survey locations into the survey database using PanoRem™. PanoRem™ can also be used to plan radiation surveys. Using this approach a more experienced surveyor can place the individual survey locations into planned surveys and the field surveyor just performs surveys at planned locations. This process will provide more accurate survey locations. The tool can also be used to brief the personnel using surveys as well as personnel supporting plant activities.

![Image](image.png)

Allows the facility to represent the plant area in photorealistic 3D format created from scans
Collect and apply radiation surveys to a specific location, viewable in a scan (above), or a keyplan (below)
Radiation Sources

PanoRem™ is used to identify radiation sources within the areas of the plant. The sources can be placed within PanoMap® using a simplified 3D model of the components. Also, they can be placed as points digitized against the surface of the components. The points can be merged inside the components.

Each source object is identified with applicable attributes. If the simplified 3D model is used to create the source, the source model can be merged within the scans to show where the sources are.

Radiation sources superimposed on laser scans
Shielding

Various types of shielding are specified within PanoRem™. The shielding can be existing plant components, permanent shielding created using lead blankets, or other shielding materials or temporary shielding erected for specific plant activities. Shielding is modeled as a polygonal structure with thickness. The thickness designates the effectiveness of the shielding. The shielding objects can be used in the estimating process as applicable. The user selects the shielding according to project activities.

Provide shielding modeling – rectangular or cylindrical.

Work Orders – Modeling of Activities Performed within the Plant

The algorithm calculates the radiation exposure for a given position and time duration. This is used by the PanoRem activities modeling process. The PanoRem™ work activity tasks represent work being performed at a particular location. The location can be stationary or a movement path.

The PanoRem™ work activity has an ID, description, Plant Component ID being worked on, Work Order designation, Scheduling Activity ID, etc. Each work activity is broken down into a specific person-identifiable task. Each task record contains Task ID, Worker ID, description, location or path, duration, and PanoRem™ Activity ID. The PanoRem™ activity tasks provide a tool to model people and locations to the work area.
Receptor path specification

Calculate expected dose for each activity, using EPRI-supplied dose algorithm providing an effective display of results against the scan model.

Place location of people, activity, and time within laser scan model space.
**PanoRem™ Processing**

The major benefit of this application is that the user can quickly process a number of “what if” processing scenarios. The typical processing selection can be done according to the following:

- Plant radiation surveys that best represent the condition for proposed work.
- The user can select a list of activities, survey or set of surveys, or applicable shielding available.
  - Some of the work activities can be done before the outage – Plant Survey A
  - Some of the activities are done during the outage – Plant Survey B

The next set of activities is done at the start of the outage:

- Survey is selected.
- Activities are selected.
- Temporary shielding might not be available.

The last activities are performed after temporary shielding is installed and scaffolding is installed. All the process activities are combined into the final work order report. Additional process selection can be done to calculate dose at waist, chest, and head levels.

![Workorder Management](image)

**Report Selection Criteria**
Results

The results can be presented in several formats. Laser scanning photorealistic plant representation provides an excellent format to illustrate the estimating results. It can be used to review the work activities as well as associated dose. The floor of the work area can be “painted” with the radiation distribution. The PanoMap® display can include the location of sources, shielding, position of people within the area, and “coloring” of the floor with radiation levels. All this data is also available on the tablet which can be used in the field. The tablet can be used for jpb briefings, walkdowns, and during the performance of the activities.
Worker’s path colored with radiation distribution

Workers placed within the work order area

**PanoRem™ Estimate Reports**

A variety of reports can be produced from PanoRem™. These reports can represent various processing scenarios, with variable dose calculation position (waist, chest, or head) on the worker’s body. The reports can be summarized by:

- Work orders
- Components
- Activity type
- Craft
- Shielding scenario
- User surveys
- Worker

Examples of reports are below:

**Activity Report**

**Work Order Report**
## Worker (Receptor) Report

<table>
<thead>
<tr>
<th>Person name</th>
<th>Activity number</th>
<th>Description</th>
<th>Activity type</th>
<th>Craft</th>
<th>P-hours</th>
<th>Dose Rt</th>
<th>Dose</th>
<th>Worker</th>
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<tbody>
<tr>
<td>RCP1</td>
<td>0020B</td>
<td>B-Install Rigging</td>
<td>Valve</td>
<td>Maint</td>
<td>2.00</td>
<td>2.40</td>
<td>4.80</td>
<td>KWA0005</td>
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<td>RCP1</td>
<td>00600</td>
<td>B-Lock Spring Supports</td>
<td>Valve</td>
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<td>2.40</td>
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<td>KWA0005</td>
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<td>B-Remove Spring Support</td>
<td>Valve</td>
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<td>2.40</td>
<td>KWA0005</td>
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<td>RCP1</td>
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<td>B-Remove/Decon Old Internals</td>
<td>Valve</td>
<td>Main/RP</td>
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<td>4.80</td>
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<td>RCP1</td>
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<td>B-Setup FME Purge Bags</td>
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## Component Report

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<th>Description</th>
<th>Activity type</th>
<th>Craft</th>
<th>No of Workers</th>
<th>P-hours</th>
<th>Est. Dose Rate (mRem/m/hr)</th>
<th>Est. Dose (Ian mRem)</th>
<th>Est. Dose (Calc mRem)</th>
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<tbody>
<tr>
<td>S351A</td>
<td>00100</td>
<td>A-Lock spring supports</td>
<td>Valve</td>
<td>Maint</td>
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<td>A-Setup FME/purge bags</td>
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<td>10.00</td>
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