Presentation

SEVRRA SOFTWARE

Internacional Atomic Energy Agency
OBJECTIVE

- Explain SEVRRA app.
Start analysis of initiating events

Initiating event applies?

YES

frequency (f) proposed by SEVRRA is correct?

YES

ANALYZE IF THE REDUCTORS PROPOSED BY SEVRRA, APPLY IN THIS STUDY AND SELECT THEM

ANO

Add new barriers not included in SEVRRA

SEVRRA evaluates the risk of analyzed yes

Add new reductors not included in SEVRRA

ANALYZE IF THE REDUCTORS PROPOSED BY SEVRRA, APPLY IN THIS STUDY AND SELECT THEM

NO

Go to analyze another Initiating Event until finishing the SEVRRA list

Analysis of other possible Initiating Events not included in SEVRRA

NO

Cange (f)
Once the performance and the impact of barriers, frequency reducers, and consequences reducers in the risk level of the initiating events in Radiotherapy practices has been understood, it is possible to carry out a risk analysis using preferably a software like SEVRRA.
SEVRRA, is a software designed as a web platform that allows to use the risk matrix method in radiotherapy using telecobalttherapy, HDR y LDR brachytherapy, and LINAC teletherapy. SEVRRA can also be used in industrial radiography. It will be improved to be used in nuclear medicine and new radiotherapy techniques (IMRT, Radiosurgery, IORT).
In order to apply the risk matrix method used by SEVRRA, it is necessary to create a work team that includes the professionals of the radiotherapy service with vast experience and knowledge of their functions.

The team must include:

- Radiotherapist
- Medical Physicist
- Dosimetrists
- Operator technician of the radiotherapy unit
- Electromedicine specialist
- Mold technician
- TAC and simulator operator
- Radiation protection officer
GENERAL CONDITIONS TO APPLY SEVRRA

Start analysis of initiating events

Initiating event applies?

frequency (f) proposed by SEVRRA is correct?

ANALYZE IF THE REDUCTORS PROPOSED BY SEVRRA, APPLY IN THIS STUDY AND SELECT THEM

Analysis of other possible Initiating Events not included in SEVRRA

SEVRRA evaluates the risk of analyzed yes

Add new reductors not included in SEVRRA

Go to analyze another Initiating Event until finishing the SEVRRA list

ADD NEW BARRIERS not included in SEVRRA

ANALYZE IF THE REDUCTORS PROPOSED BY SEVRRA, APPLY IN THIS STUDY AND SELECT THEM

YES

NO

YES

NO

Cange (f)
In SEVRRA, the initiating events found in the risk analysis, developed by FORO, are grouped in the different stages and sub-stages of the practices, and the navigation between them is similar to a Windows file.
In SEVRRA, the initiating events found in the risk analysis, developed by FORO, are grouped in the different stages and sub-stages of the practices, and the navigation between them is similar to a Windows file. **Example of navigation within the stages and sub-stages**
Example of navigation within the stages and sub-stages to analyze the different initiator events grouped in them.

HOW ARE IE ORGANIZED IN SEVRRA?

Start -> Linear Accelerator
Stage 1: Initial setup of the equipment
Stage 2: Acceptance and Commissioning
   Substage 1: LINAC: with consequent
   Substage 2: Planning System (TPS)
   RH -> IE-1: Error in geometric configuration
   RM -> IE-2: Error in configuration
   RM -> IE-3: Error in wedge configuration
   RM -> IE-4: Error in configuration of control
   IE-5: Error in geometrical system
   IE-6: Error in beam characterization
   IE-7: Input of conversion coefficient
   IE-8: Input of erroneous field factors
   New Initiator Event

Stage 3: Equipment maintenance
Stage 4: Treatment clinic prescription
Stage 5: Patient anatomical data acquisition
Example of navigation within the stages and sub-stages to analyze a specific initiator event.
By analyzing each initiator event, the barriers, frequency reducers and reduction of consequences proposed by SEVRRA, can be evaluated to select those that are implemented in the radiotherapy service that we are analyzing.
Users, at this point, must read the situation or event that initiates the accident, question whether it is possible that this event can occur in their practice, and analyze between possible barriers, frequency reducers and consequences reducers which are those that are operative in their facility.
When selecting the barriers and reducers, SEVRRA assigns to each of them the corresponding weights (robustness) according to the criteria established in the methodology of the Risk Matrix. The calculation of Risk is done considering the multiplication of those weights.
Once the existing barriers and reducers in the radiotherapy service are selected, the system can calculate the risk resulting from the initiating event by pressing the "calculate risk" button of the application.
HOW ARE RISK LEVELS CALCULATED?

To register and save the evaluation progress, press the "Record" button of the application.
HOW ARE RISK LEVELS CALCULATED?

The analysis is repeated for each initiating event, until the practice is completed.
Users have the option to improve the analysis by adding barriers, reducers and initiating events.

<table>
<thead>
<tr>
<th>Frequency Reducers</th>
<th>Barriers</th>
<th>Consequence Reducers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training of the physics, that includes the entire TPS commissioning process, the tests to be performed and initial lessons learned</td>
<td>Comparison of TPS calculations results for tests cases against direct phantom measurement during TPS commissioning</td>
<td>Weekly in vivo diameter by which dose delivery errors can be detected</td>
</tr>
<tr>
<td></td>
<td>Verification of the treatment plan data transferred to the accelerator</td>
<td>At the daily patient setup, the radiotherapists can detect geometric or dose errors by visual signs, such as skin redness, etc.</td>
</tr>
<tr>
<td></td>
<td>Verification of the treatment plan data transferred to the accelerator</td>
<td>QA tests of the TPS daily, monthly, quarterly and annually. When a significant inconsistency is detected, instruments are stopped</td>
</tr>
<tr>
<td></td>
<td>Weekly medical evaluation of the patient can detect errors in treatment delivery or from previous stages</td>
<td>Weekly medical evaluation of the patient can detect errors in treatment delivery or from previous stages</td>
</tr>
</tbody>
</table>

Compute Risk Level

**ADD BARRIERS AND REDUCERS**
As the analysis is completed, the risk profile of the facility will be outlined:
Once completed, the user can see in a summary report the result of his analysis, comparing it with that of a reference facility.

### 3. Risk Assessment Results

#### 3.1 Summary

The risk assessment results indicate that taking into account existing safety barriers, frequency and consequences reducers in your Radiotherapy Service, the next risk levels has been reached for initiating events by stage:

<table>
<thead>
<tr>
<th>Num</th>
<th>Stage</th>
<th>Risk Very High (RMH)</th>
<th>Risk High (RH)</th>
<th>Risk Medium (RM)</th>
<th>Risk Low (RL)</th>
<th>No Apply (NA)</th>
<th>Analyzed</th>
<th>Total by stage</th>
<th>Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Initial Setup of the equipment</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>10</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Acceptance and Commissioning</td>
<td>0</td>
<td>4</td>
<td>20</td>
<td>0</td>
<td>0</td>
<td>24</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Equipment Maintenance</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Taking data from patient for treatment planning</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>16</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Development of treatment plan</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>20</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Development of moulds. Consequences for patients with</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Implementation of treatment</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>14</td>
<td>0</td>
<td>66</td>
<td>66</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total User</td>
<td>0</td>
<td>42</td>
<td>86</td>
<td>10</td>
<td>0</td>
<td>132</td>
<td>132</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total Reference</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

#### 3.2 Graphics: Current Practice vs. Reference Practice

![Current Practice vs. Reference Practice](current-reference-practice.png)
The system tells the user in a summary what are the barriers that are missing to the facility in order to reduce their risk level.

### 3.4 Accident sequences with high and very high risk

Risk Assessment results show that due to the lack of barriers or reducers, the next sequences have High Risk (RH) or Very High Risk (VHR):

<table>
<thead>
<tr>
<th>IE Code</th>
<th>Initiating Event</th>
<th>Reference Risk</th>
<th>Calculated Risk</th>
<th>Missing Barriers and Reducers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Co60-PAC2.1</td>
<td>Error in the calibration coefficient of the ionization chamber and electrometer.</td>
<td>RM</td>
<td>RH</td>
<td>B-222: When performing commissioning tests, the air kerma rate is measured at 1m distance and compared with the value reported by the source manufacturer on the certificate. The measurement can be made in terms of absorbed dose to water and this value can be correlated with the air kerma values reported on the certificate</td>
</tr>
<tr>
<td>Co60-PAC2.16</td>
<td>Error in recording data measured during commissioning for input to the treatment planning system (TPS)</td>
<td>RM</td>
<td>RH</td>
<td>CR-336: Annual external audit. Auditing procedure. Test for dose rate measurement at points around the irradiation head. CR-377: At the weekly medical evaluation of the patient, errors in treatment delivery can be detected</td>
</tr>
<tr>
<td>Co60-PAC2.17</td>
<td>Incorrect generation of data tables for manual treatment planning (for example, depth dose curves)</td>
<td>RH</td>
<td>RH</td>
<td>B-277: Redundant verification of the records by another medical physicist. CR-338: Annual external audit. Review of the generated tables based on commissioning tests CR-377: At the weekly medical evaluation of the patient, errors in treatment delivery can be detected</td>
</tr>
<tr>
<td>Co60-PAC2.24</td>
<td>Incomplete commissioning of the CT equipment, leading to errors in the density and geometric scales</td>
<td>RL</td>
<td>RH</td>
<td>B-229: Portal image taken during initial treatment session for evaluation by the radiation oncologist and the medical physicist, by which geometric treatment errors can be detected CR-332: Annual external audit CR-350: Weekly portal image whereby geometric errors can be detected CR-377: At the weekly medical evaluation of the patient, errors in treatment delivery can be detected</td>
</tr>
</tbody>
</table>
The system is also enabled to include, in a future step, different formats of "aids" for a better understanding of the initiating events, and the ways of reducing the probability of occurrence.