

Presentation

SEVRRA SOFTWARE

Internacional Atomic Energy Agency

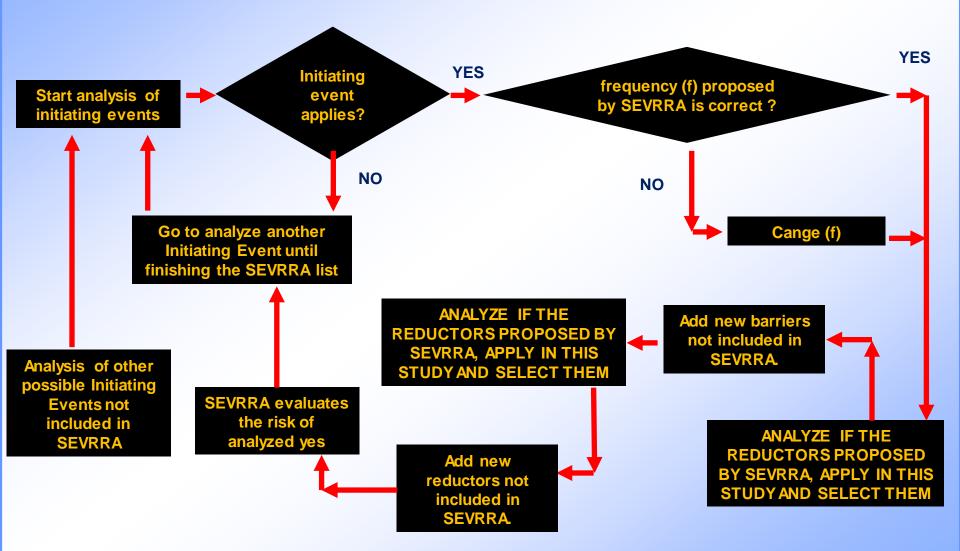


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OBJECTIVE

Foro iberoamericano de Organ Reguladores Radiológicos y N	lucleares		
Start Practice	es My Account	About SEVRRA	Help Exit
Service=>Cobalt 60 Stage 1: Initial setup of the equipment Substage 1: With consequences for patien QRL=> IE-1: Deficiency in the manufa QRM=> IE-2: Supply of a wrong sourc QRM=> IE-3: Error in the manufacture QRM=> IE-4: Incorrect source alignme QRM=> IE-5: Significant variations in 1 Wew Initiator Event Substage 2: Consequences for radiation '	Name: Deficiency in the manufacturing process causi Description: Consequences: Help references: Comment and modification proposals list Select from the list below, those barriers and reducers	ng an inhomogeneous distribution of 60Co radioactive material in the so	service ? Yes No Risk FVL PVL CH =
⊕Substage 3: With consequences for the p Stage 2: Acceptance and Commissioning	Frequency Reducers	Barriers	Consequence Reducers
Stage 2: Acceptance and commissioning Stage 3: Equipment maintenance. Stage 4: Taking data from each patient for tr Stage 5: Development of treatment plan Stage 6: Development of molds. Consequenc Stage 7: Implementation of treatment	Purchase of sources only from recognized manufacturers	 Treatment planning of test cases on the TPS and comparison with direct measurements, as part of TPS commissioning Acceptance test: control test of dose rate, beam symmetry and flatness for specified fields Commissioning tests: control of dose rate and flatness for all fields 	External audit. Physics aspects: auditing procedures for measurement of dose rate and beam flatness control for some randomly selected fields
	Reuse frequency reducer		New consequence reducer
			Reuse consequence reducer
	Compute Risk Level	 New Barrier Reuse Barrier 	
>	(Lee	n Badiatarania - REVIDBA 2.0 (English Varsián - NDAET)	
	Sistema de Evaluación del Riesgo el	n Radioterapia - SEVRRA 3.0 (English Versión_DRAFT)	

GENERAL CONDITIONS TO APPLY SEVRRA





Risk Analysis with SEVRRA.

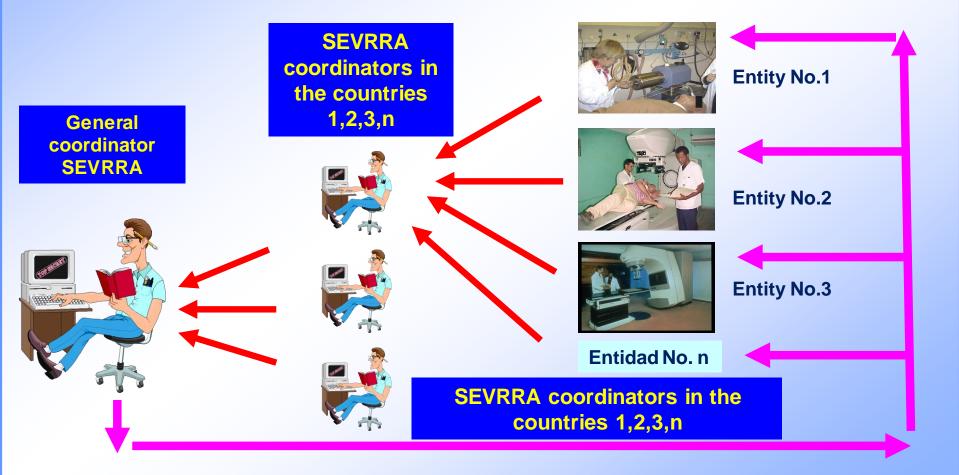
Once the performance and the impact of barriers, frequency reducers, and consequences reducers in the risk level of the initiating events in Radiotherapy practices has been understood, it is possible to carry out a risk analysis using preferably a software like SEVRRA.

FORO SEVRRA Foro iberoamericano de Orgar Reguladores Radiológicos y N			
Start Practice	es My Account	About SEVRRA	Help Exit
Service=>Cobalt 60 Stage 1: Initial setup of the equipment Substage 1: With consequences for patien QRL=> IE-1: Deficiency in the manufa QRM=> IE-2: Supply of a wrong sourc QRM=> IE-3: Error in the manufacture QRM=> IE-4: Incorrect source alignme QRM=> IE-5: Significant variations in 1 New Initiator Event Substage 2: Consequences for radiation ,	Name: Deficiency in the manufacturing process causing Description: Consequences: Help references: Comment and modification proposals list Select from the list below, those barriers and reducers	ng an inhomogeneous distribution of 60Co radioactive material in the so	service ? Yes No Risk FVL PVL CH
⊕Substage 3: With consequences for the p ⊕Stage 2: Acceptance and Commissioning	Frequency Reducers	Barriers	Consequence Reducers
⊕Stage 3: Equipment maintenance. ⊕Stage 4: Taking data from each patient for tr	Purchase of sources only from recognized manufacturers	Treatment planning of test cases on the TPS and comparison with direct measurements, as part of TPS commissioning	External audit. Physics aspects: auditing procedures for measurement of dose rate and beam flatness control for some randomly selected fields ?
 Bage 5: Development of treatment plan Stage 6: Development of molds. Consequenc Stage 7: Implementation of treatment 		Acceptance test: control test of dose rate, beam symmetry and flatness for specified fields Omnissioning tests: control of dose rate and flatness for all	
	New frequency reducer Reuse frequency reducer	Tields 😢 👁	New consequence reducer Reuse consequence reducer
	Compute Risk Level	New Birrier ReuseRarrier	



WHAT IS 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).





GENERAL CONDITIONS TO APPLY SEVRRA

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



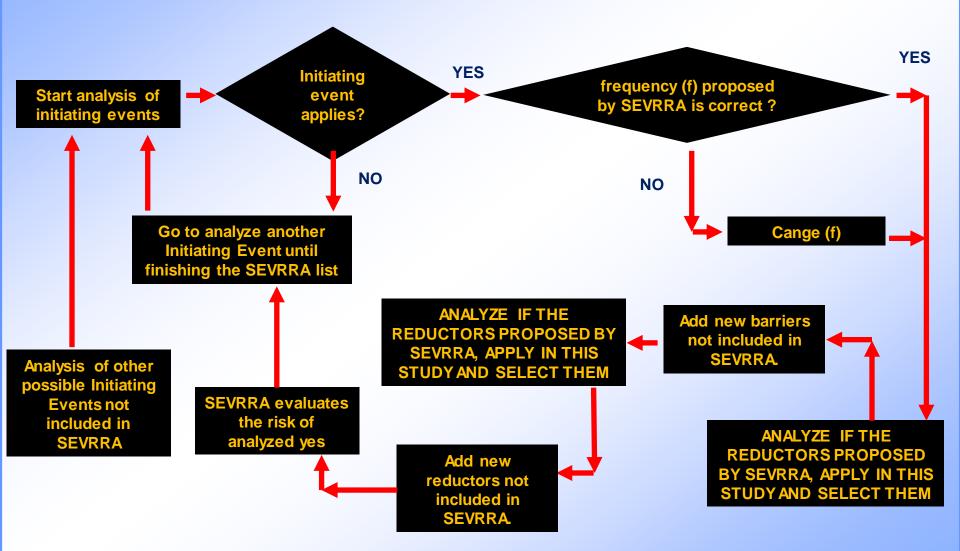








GENERAL CONDITIONS TO APPLY SEVRRA





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

FORO SEVRRA Foro iberoamericano de Organ Reguladores Radiológicos y No						a			1
Start Practices	My Account			About	SEVRRA			Help	Exit
Service=>Linear Accelerator	Struct Summary (in	that in S Local							roport
Stage 1: Initial setup of the equipment ⊕ Stage 2: Acceptance and Commissioning	Num. Stage	Risk Very High (RVH)	Risk High (RH)	Risk Medium (RM)	Risk Low (RL)	Not Apply (NA)	Recorded	Total by Stage	Completed
• Stage 3: Equipment maintenance. • Stage 4: Treatment Clinic Prescription	1 Initial setup of the equipment	0	0	2	0	0	2	2	v
Stage 5: Patient anatomical data acquisition	2 Acceptance and Commissioning	0	5	5	1	0	11	27	8
€ Stage 6: Volume delineation	3 Equipment maintenance.	0	1	2	0	0	3	3	I
⊕Stage 7: Treatment Planning ⊕Stage 8: Preparation of molds	4 Treatment Clinic Prescription	0	2	1	1	0	4	8	8
€Stage 9: Beginning of treatment	5 Patient anatomical data acquisition	0	1	1	1	0	3	10	8
E Stage 10: Positioning for daily treatment	6 Volume delineation	0	3	1	2	0	6	6	S
⊕Stage 11: Implementation of treatment	7 Treatment Planning	0	1	2	0	0	3	16	8
	8 Preparation of molds	0	2	1	1	0	4	4	V
	9 Beginning of treatment	1	1	1	0	0	3	17	8
	10 Positioning for daily treatment	0	2	1	1	0	4	13	8
	11 Implementation of treatment	0	1	0	0	0	1	42	8
	Total User: Total Reference:	-	19 0	17 8	7 36	0 0	44 44	148 148	4 0
	Sistema de Evaluación del Ries	go en Radioterapia	i - SEVRRA 3	3.0 (English Versi	ón_DRAFT)				



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**

SEVRRA

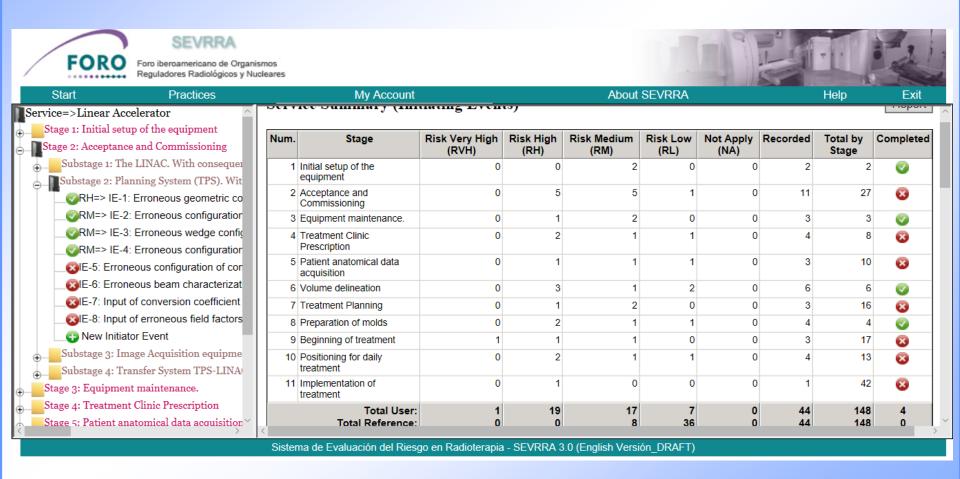


Foro iberoamericano de Organismos Reguladores Radiológicos y Nucleares

Start	Practices		My Account			About	SEVRRA			Help	Exit
Service=>Linear Accele	erator	SULL	ice Summary (rm	tating Even	,						Hoport
⊖ Stage 1: Initial setup o ⊕ Substage 1: With i	f the equipment mplications for radiation	Num.	Stage	Risk Very High (RVH)	Risk High (RH)	Risk Medium (RM)	Risk Low (RL)	Not Apply (NA)	Recorded	Total by Stage	Completed
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Stage 3: Equipment m	naintenance.		Acceptance and Commissioning	0	5	5	1	0	11	27	8
⊕Stage 4: Treatment Cl	-	3	Equipment maintenance.	0	1	2	0	0	3	3	v
⊕Stage 5: Patient anato Stage 6: Volume delin	omical data acquisition leation		Treatment Clinic Prescription	0	2	1	1	0	4	8	8
Stage 7: Treatment Pl			Patient anatomical data acquisition	0	1	1	1	0	3	10	8
• Stage 8: Preparation of		6	Volume delineation	0	3	1	2	0	6	6	v
• Stage 9: Beginning of		7	Treatment Planning	0	1	2	0	0	3	16	8
Stage 10: Positioning		8	Preparation of molds	0	2	1	1	0	4	4	v
• Stage 11: Implementat	tion of treatment	9	Beginning of treatment	1	1	1	0	0	3	17	8
			Positioning for daily treatment	0	2	1	1	0	4	13	8
			Implementation of treatment	0	1	0	0	0	1	42	8
<	>	<	Total User: Total Reference:		19 0	17 8	7 36	0	44 44	148 148	
		Sisten	na de Evaluación del Ries	go en Radioterapia	- SEVRRA 3	3.0 (English Versi	ión_DRAFT)				



Example of navigation within the stages and sub-stages to analyze the different initiator events grouped in them.





Example of navigation within the stages and sub-stages to analyze a specific initiator event.

FORO FORO Eroamericano de Organismos Reguladores Radiológicos y Nucleares					
Start Practices	My Ac		About SEVRRA		Help Exit
Service=>Linear Accelerator	Location=> Linear Accelerator/Stage 2/Sub	stage 2/Initiating Event 5			
Stage 1: Initial setup of the equipment			Initiating Event		Does the initiating
Stage 2: Acceptance and Commissioning	Code: AL-P	AC2.23			event Apply in your service ?
Substage 1: The LINAC. With consequences for the patient	Name: Error	eous configuration of compensators	s or bolus on the TPS		Yes No O
G Substage 2: Planning System (TPS). With consequences for the patien	Description:				Yes V No V
QRH=> IE-1: Erroneous geometric configuration of the accelerator (Consequences:				Risk
RM=> IE-2: Erroneous configuration of the multileaf collimator on	Help references:				FL PH CVH = RH
RM=> IE-3: Erroneous wedge configuration into the TPS					nt nn ovn - kn
QRM=> IE-4: Erroneous configuration of conformal shielding blocks					
8 E-5: Erroneous configuration of compensators or bolus on the TF	Comment and modification proposals list				
E-8: Erroneous beam characterization data and beam output on t Sector 2 and the sector 2	Comment and modification proposals list				
SVE-7: Input of conversion coefficient to convert Hounsfield units to	Select from the list below, those barriers and	d reducers that are impleme	nted in your facility:		
8 E-8: Input of erroneous field factors on the TPS		-			
Alex le Meter Funct	·				
New Initiator Event Schetters of Image Administration equipment 1/15th correspondence for ant	Frequency Reducer		Barriers		Consequence Reducers
€Substage 3: Image Acquisition equipment. With consequences for pat	Training of the physicist, that includes the entire	TPS commissioning process,	Comparison of TPS calculations results for tests cases against direct phant	m 🗆	Consequence Reducers
← Substage 3: Image Acquisition equipment. With consequences for pat ← Substage 4: Transfer System TPS-LINAC. With consequences for pati		TPS commissioning process,	Comparison of TPS calculations results for tests cases against direct phant measurement during TPS commissioning		
Substage 3: Image Acquisition equipment. With consequences for pat Substage 4: Transfer System TPS-LINAC. With consequences for pati Stage 3: Equipment maintenance.	Training of the physicist, that includes the entire	TPS commissioning process,	Comparison of TPS calculations results for tests cases against direct phant	he 🗆	Annual external audit. Control test of dose rate in reference conditions 2 🗢
Substage 3: Image Acquisition equipment. With consequences for pat Substage 4: Transfer System TPS-LINAC. With consequences for pati Stage 3: Equipment maintenance. Stage 4: Treatment Clinic Prescription	Training of the physicist, that includes the entire	TPS commissioning process,	Comparison of TPS calculations results for tests cases against direct phant measurement during TPS commissioning ♥ ● In-vivo dosimetry in initial treatment session, to verify the delivered against planned doses, which allows for error detection in dose delivery ♥ ● Independent verification of the treatment planning by a different medical ph	he	Annual external audit. Control test of dose rate in reference conditions
Substage 3: Image Acquisition equipment. With consequences for pat Substage 4: Transfer System TPS-LINAC. With consequences for pati Stage 3: Equipment maintenance. Stage 4: Treatment Clinic Prescription Stage 5: Patient anatomical data acquisition	Training of the physicist, that includes the entire	TPS commissioning process,	Comparison of TPS calculations results for tests cases against direct phant measurement during TPS commissioning ♥ ● In-vivo dosimetry in initial treatment session, to verify the delivered against planned doses, which allows for error detection in dose delivery ♥ ● Independent verification of the treatment planning ♥ ● Independent verification of the treatment planning ♥ ●	he	Annual external audit. Control test of dose rate in reference conditions Weekly in-vivo dosimetry by which dose delivery errors can be detected At the daily patient setup, the radiotherapy technologists can detect geometric or dose errors by visual signs, such as skin reddening, etc. QA tests of the TPS (daily, weekly, monthly, quarterly and annually). When a
Substage 3: Image Acquisition equipment. With consequences for pat Substage 4: Transfer System TPS-LINAC. With consequences for pati Stage 3: Equipment maintenance. Stage 4: Treatment Clinic Prescription Stage 5: Patient anatomical data acquisition Stage 6: Volume delineation	Training of the physicist, that includes the entire the tests to be performed and related lessons le	TPS commissioning process,	Comparison of TPS calculations results for tests cases against direct phant measurement during TPS commissioning measurement during TPS commissioning measurement during TPS commission to verify the delivered against planned doses, which allows for error detection in dose delivery measurement during the treatment planning by a different medical ph than the one who made the planning measurement medical input on the TPS by a different medical	he Construction of the con	Annual external audit. Control test of dose rate in reference conditions O Weekly in-vivo dosimetry by which dose delivery errors can be detected O At the daily patient setup, the radiotherapy technologists can detect geometric or dose errors by visual signs, such as skin reddening, etc. O QA tests of the TPS (daily, weekly, monthly, quarterly and annually). When a significant inconsistency is detected, treatments are stopped O
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Substage 3: Image Acquisition equipment. With consequences for pat Substage 4: Transfer System TPS-LINAC. With consequences for pati Stage 3: Equipment maintenance. Stage 4: Treatment Clinic Prescription Stage 5: Patient anatomical data acquisition Stage 6: Volume delineation Stage 7: Treatment Planning Stage 8: Preparation of molds Stage 9: Beginning of treatment Stage 10: Positioning for daily treatment	Training of the physicist, that includes the entire the tests to be performed and related lessons le	TPS commissioning process,	Comparison of TPS calculations results for tests cases against direct phant measurement during TPS commissioning ♥ ● In-vivo dosimetry in initial treatment session, to verify the delivered against planned doses, which allows for error detection in dose delivery ♥ ● Independent verification of the treatment planning by a different medical ph than the one who made the planning ♥ ● Redundant verification of the data input on the TPS by a different medical physicist from the one who made the input ♥ ●		Annual external audit. Control test of dose rate in reference conditions Q Weekly in-vivo dosimetry by which dose delivery errors can be detected Q At the daily patient setup, the radiotherapy technologists can detect geometric or dose errors by visual signs, such as skin reddening, etc. Q QA tests of the TPS (daily, weekly, monthly, quarterly and annually). When a significant inconsistency is detected, treatments are stopped Q Weekly medical evaluation of the patient can detect errors in treatment delivery or from previous stages Q

WHAT DO THE INITIATING EVENTS GROUP?

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.

FORO FORO Foro Iberoamericano de Organismos Reguladores Radiológicos y Nucleares			
Start Practices	My Account	About SEVRRA	Help Exit
Service=>Linear Accelerator Stage 1: Initial setup of the equipment Substage 2: Acceptance and Commissioning Substage 2: The LINAC. With consequences for the patient Substage 2: Planning System (TPS). With consequences for the patient RH=> IE-1: Erroneous geometric configuration of the accelerator RH=> IE-2: Erroneous configuration of the multileaf collimator on RH=> IE-3: Erroneous wedge configuration into the TPS RH=> IE-4: Erroneous configuration of compensators or bolus on the TF E-6: Erroneous beam characterization data and beam output on 1 Substage 1: Initial setup of the configuration of the setup of the setup of the the setup of	Location=> Linear Accelerator/Stage 2/Substage 2/Initiating Event 5 Code: AL-PAC2.23 Name: Erroneous configuration of compensator Description: Consequences: Help references: Comment and modification proposals list Select from the list below, those barriers and reducers that are implement		Does the initiating event Apply in your service ? Yes ● No ○ Risk FL PH CVH = RH
Weight and the second state of the second	- Frequency Reducers	Barriers	Consequence Reducers
Substage 3: Image Acquisition equipment. With consequences for pat Substage 4: Transfer System TPS-LINAC. With consequences for pati Stage 3: Equipment maintenance. Stage 4: Treatment Clinic Prescription Stage 5: Patient anatomical data acquisition Stage 5: Patient anatomical data acquisition Stage 7: Treatment Planning Stage 8: Preparation of molds Stage 9: Beginning of treatment Stage 10: Positioning for daily treatment Stage 11: Implementation of treatment	Image: Training of the physicist, that includes the entire TPS commissioning process, the tests to be performed and related lessons learned Image: The tests to be performed and related lessons learned Image: The tests to be performed and related lessons learned Tmage: Tma	Comparison of TPS calculations results for tests cases against direct phantom measurement during TPS commissioning ♥ ● In-vivo dosimetry in initial treatment session, to verify the delivered against the planned doses, which allows for error detection in dose delivery ● ● Independent verification of the treatment planning by a different medical physicist than the one who made the planning ● Redundant verification of the data input on the TPS by a different medical physicist from the one who made the input ● ●	✓ Annual external audit. Control test of dose rate in reference conditions ● ● ✓ Weekly in-vivo dosimetry by which dose delivery errors can be detected ● ● ✓ At the daily patient setup, the radiotherapy technologists can detect geometric or dose errors by visual signs, such as skin reddening, etc. ● ● ✓ QA tests of the TPS (daily, weekly, monthly, quarterly and annually). When a significant inconsistency is detected, treatments are stopped ● ● ✓ Weekly medical evaluation of the patient can detect errors in treatment delivery or from previous stages ● ●
€orage 11. implementation of meatibelit		New Barrier Reuse Barrier	New consequence reducer Reuse consequence reducer

Compute Risk Level



HOW IS RISK ANALYSIS PERFORMED?

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.

FORO FORO Foro Iberoamericano de Organismos Reguladores Radiológicos y Nucleares Start Practices	Му Асе		About SEV/RA			Help Exit
Start Practices			ADOUL SEVRRA			Help Exit
Service=>Linear Accelerator	Location=> Linear Accelerator/Stage 2/Subst	age 2/Initiating Event 5				
Stage 2: Acceptance and Commissioning	Code: AL-PA	00.00	Initiating Event			Does the initiating event Apply in your
Substage 1: The LINAC. With consequences for the patient		22.23	•			service ?
Substage 2: Planning System (TPS). With consequences for the patient	Name: Errone	ous configuration of compensators or bolu	us on the TPS 🤍			Yes 🔍 No 🔿
QRH=> IE-1: Erroneous geometric configuration of the accelerator	Description:					
QRM=> IE-2: Erroneous configuration of the multileaf collimator on	Consequences:					Risk
QRM=> IE-3: Erroneous wedge configuration into the TPS	Help references:					FL PH CVH = RH
QRM=> IE-4: Erroneous configuration of conformal shielding blocks					I.	
CHE-5: Erroneous configuration of compensators or bolus on the TF						
CHE-8: Erroneous beam characterization data and beam output on t	Comment and modification proposals list					
RHE-7: Input of conversion coefficient to convert Hounsfield units to			0.00			
E-8: Input of erroneous field factors on the TPS	Select from the list below, those barriers and	reducers that are implemented i	n your facility:			
New Initiator Event	Frequency Reducers		Barriers		Conseque	nce Reducers
Substage 3: Image Acquisition equipment. With consequences for pat	Training of the physicist, that includes the entire 1	TPS commissioning process,	Comparison of TPS calculations results for tests cases against direct pha	motor		f dose rate in reference conditions 🛛 🔍
Substage 4: Transfer System TPS-LINAC. With consequences for pati	the tests to be performed and related lessons lea		measurement during TPS commissioning 2	Ň		
🕞 🔤 Stage 3: Equipment maintenance.	4		In-vivo dosimetry in initial treatment session, to verify the delivered again	the		dose delivery errors can be detected <table-cell> 🔘</table-cell>
Stage 4: Treatment Clinic Prescription	3	1 2	planned doses, which allows for error detection in dose delivery 😢 🔍		At the daily patient setup, the radiot dose errors by visual signs, such as	herapy technologists can detect geometric or
Stage 5: Patient anatomical data acquisition			Independent verification of the treatment planning by a different medical p than the one who made the planning 2 0			monthly, guarterly and annually). When a
E Stage 6: Volume delineation			Redundant verification of the data input on the TPS by a different medical		significant inconsistency is detected	
Stage 7: Treatment Planning	New frequency reducer		physicist from the one who made the input 🕄 🔍			atient can detect errors in treatment delivery or
E Stage 8: Preparation of molds	Reuse frequency reducer	₩X.		ΔD	from previous stages 🕜 🔘	
⊕Stage 9: Beginning of treatment		1 3		12	1	
E Stage 10: Positioning for daily treatment				<u> </u>	2	
Stage 11: Implementation of treatment		•		V		
			New Barrier		New consequence reducer	
		0	Reuse Barrier		Reuse consequence reducer	
	L					
	Compute Risk Level					



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

FORO Eroamericano de Organismos Reguladores Radiológicos y Nucleares						1
Start Practices	My Account		About SEVRRA		Help	Exit
Service=>Linear Accelerator Stage 1: Initial setup of the equipment Stage 2: Acceptance and Commissioning Substage 1: The LINAC. With consequences for the patient CRH=> IE-1: Erroneous geometric configuration of the accelerator CRH=> IE-2: Erroneous configuration of the multileaf collimator on CRH=> IE-3: Erroneous wedge configuration into the TPS CRH=> IE-4: Erroneous configuration of conformal shielding block SIE-5: Erroneous beam characterization data and beam output on SIE-7: Input of conversion coefficient to convert Hounsfield units to	Name: Description: Consequences: Help references: Comment and modification Select from the list below	proposals list	of compensators or bolus on the TPS 🥏 reducers that are implemented in your facility:		In your service ? Yes Yes No Risk FL PH CVH =	
CIE-7: input of conversion coefficient to convert noursheld drifts to	Frequency R	educers	Barriers	Cons	sequence Reducers	
 New Initiator Event Substage 3: Image Acquisition equipment. With consequences for pa Substage 4: Transfer System TPS-LINAC. With consequences for pat Stage 3: Equipment maintenance. Stage 4: Treatment Clinic Prescription Stage 5: Patient anatomical data acquisition Stage 6: Volume delineation Stage 7: Treatment Planning Stage 9: Beginning of treatment Stage 10: Positioning for daily treatment 	Training of the physicist, th TPS commissioning proce- performed and related less New frequency reducer Reuse frequency reducer	ss, the tests to be	Comparison of TPS calculations results for tests cases against greet phantom measurement during TPS commist Normal=>8 In-vivo dosimetry minimar rearment of sign to verify the delivered against the plan et of sits which allows for error detection in dost delivery ✓ Independent verification of the treatment planning by a different medical physicist than the one who made the planning ✓ Redundant verification of the data input on the TPS by a different medical physicist from the one who made the input	reference condi Weekly in-vivo c errors can be de At the daily patie technologists ca visual signs, suc QA tests of the and annually).v detected, treatm Weekly medical	dosimetry by which dose de	errors by
Stage 8: Preparation of molds Stage 9: Beginning of treatment Stage 10: Positioning for daily treatment	· · ·		Redundant verification of the data input on the TPS by a different medical physicist from the one who	detected, treatm	nents are stopped 😢 🔘 I evaluation of the patient ca	ar



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.

FORE SEVRRA Fore literoamericano de Organismos Reguladores Radiológicos y Nucleares						
Start Practices	N	ly Account		About SEVRRA		Help Exit
Service=>Linear Accelerator	Location=> Linear Accelerator/Stage 2	·				i neip entr
Stage 1: Initial setup of the equipment		outstage 2 minuting 2 tent 5		Initiating Event		Does the initiating
Stage 2: Acceptance and Commissioning	Code:	AL-PAC2.23		induing Literi		event Apply in your
Substage 1: The LINAC. With consequences for the patient	Name:	_				service ?
Substage 2: Planning System (TPS). With consequences for the patien	Description	Erroneous configuration of compensators	s or bolu	s on the TPS 🤍		Yes No O
QRH=> IE-1: Erroneous geometric configuration of the accelerator	Description: Consequences:					
QRM=> IE-2: Erroneous configuration of the multileaf collimator on	Help references:					Risk
QRM=> IE-3: Erroneous wedge configuration into the TPS	http://terenets.	1				FL PVL CVH = RM
QRM=> IE-4: Erroneous configuration of conformal shielding blocks						
ESE-5: Erroneous configuration of compensators or bolus on the TF	Comment and modification proposals list	1				
8/E-8: Erroneous beam characterization data and beam output on t	Comment and modification proposals list	1				
E3/E-7: Input of conversion coefficient to convert Hounsfield units to	Select from the list below, those barrier	s and reducers that are impleme	nted in	1 your facility:		
BYE-8: Input of erroneous field factors on the TPS						
New Initiator Event	Frequency Red	ucers		Barriers		Consequence Reducers
 Bubstage 3: Image Acquisition equipment. With consequences for pat Bubstage 4: Transfer System TPS-LINAC. With consequences for pati 	Training of the physicist, that includes the		\checkmark	Comparison of TPS calculations results for tests cases against direct phantom	~	Annual external audit. Control test of dose rate in reference conditions <table-cell> 🔘</table-cell>
Stage 3: Equipment maintenance.	the tests to be performed and related less	ons learned V 🛡		measurement during TPS commissioning 🔮 🔵 In-vivo dosimetry in initial treatment session, to verify the delivered against the		Weekly in-vivo dosimetry by which dose delivery errors can be detected 20
Stage 4: Treatment Clinic Prescription				planned doses, which allows for error detection in dose delivery 2 🔍		At the daily patient setup, the radiotherapy technologists can detect geometric or
Stage 5: Patient anatomical data acquisition				Independent verification of the treatment planning by a different medical physicist		dose errors by visual signs, such as skin reddening, etc. 😢 🔍
Stage 6: Volume delineation				than the one who made the planning 😢 🔍		QA tests of the TPS (daily, weekly, monthly, quarterly and annually). When a
Stage 7: Treatment Planning	New frequency reducer		\checkmark	Redundant verification of the data input on the TPS by a different medical physicist from the one who made the input 2		significant inconsistency is detected, treatments are stopped 😢 🔍 Weekly medical evaluation of the patient can detect errors in treatment delivery or
Stage 8: Preparation of molds	Reuse frequency reducer	L				from previous stages 😢 🔍
Stage 9: Beginning of treatment						
Stage 10: Positioning for daily treatment						
Stage 11: Implementation of treatment						
~				New Barrier		
			0	Reuse Barrier		New consequence reducer
					0	Reuse consequence reducer
	Compute Risk evel					



To register and save the evaluation progress, press the "Record" button of the application.

FORD SEVERA Foro iberoamericano de Organismos Reguladores Radiológicos y Nucleares Start Practices		fv Account		About SEVRRA		Help Exit
Service=>Linear Accelerator	Location=> Linear Accelerator/Stage 2	Substage 2/Initiating Event 5				
Stage 1: Initial setup of the equipment				Initiating Event		Does the initiating
Stage 2: Acceptance and Commissioning	Code:	AL-PAC2.23		initiating Event		event Apply in your
Substage 1: The LINAC. With consequences for the patient	Name:	Erroneous configuration of compensato	re or bob			service ?
Substage 2: Planning System (TPS). With consequences for the patien	Description:	Enoneous comparation of compensato	IS OF DOIL	as on the TP3		Yes No O
RH=> IE-1: Erroneous geometric configuration of the accelerator.	Consequences:					Risk
QRM=> IE-2: Erroneous configuration of the multileaf collimator on	Help references:					FL PVL CVH = RM
ORM=> IE-3: Erroneous wedge configuration into the TPS ORM=> IE-4: Erroneous configuration of conformal shielding blocks						
KM=> IE-4: Erroneous configuration of conformal shielding blocks KME-5: Erroneous configuration of compensators or bolus on the TF						
SE-8: Erroneous beam characterization data and beam output on t	Comment and modification proposals list	1				
Control Con						
SE-8: Input of erroneous field factors on the TPS	Select from the list below, those barrier	s and reducers that are implem	ented i	in your facility:		
New Initiator Event	Frequency Rec	lucars		Barriers		Consequence Reducers
🕞 🔤 Substage 3: Image Acquisition equipment. With consequences for pat	Training of the physicist, that includes the			Comparison of TPS calculations results for tests cases against direct phantom		Annual external audit. Control test of dose rate in reference conditions 10
🕞 🔤 Substage 4: Transfer System TPS-LINAC. With consequences for pati	the tests to be performed and related less			measurement during TPS commissioning 🛛 🔘	_	
🕀 🔤 Stage 3: Equipment maintenance.				In-vivo dosimetry in initial treatment session, to verify the delivered against the		Weekly in-vivo dosimetry by which dose delivery errors can be detected <table-cell> 🗢</table-cell>
E Stage 4: Treatment Clinic Prescription				planned doses, which allows for error detection in dose delivery 😵 🔵 Independent verification of the treatment planning by a different medical physicist		At the daily patient setup, the radiotherapy technologists can detect geometric or dose errors by visual signs, such as skin reddening, etc. 😧 🔘
E Stage 5: Patient anatomical data acquisition			. 🗹	than the one who made the planning 2		QA tests of the TPS (daily, weekly, monthly, quarterly and annually). When a
⊕Stage 6: Volume delineation				Redundant verification of the data input on the TPS by a different medical		significant inconsistency is detected, treatments are stopped 😢 🔘
E Stage 7: Treatment Planning	New frequency reducer			physicist from the one who made the input 😢 🖲	V	Weekly medical evaluation of the patient can detect errors in treatment delivery or from previous stages 🕑 🔍
⊕Stage 8: Preparation of molds	Reuse frequency reducer					irom previous stages 🐨 👻
Stage 9: Beginning of treatment						
Stage 10: Positioning for daily treatment Stage 11: Implementation of treatment						
⊕Stage 11. Implementation of reachent				New Barrier		
			ŏ	Reuse Barrier	- 🗘	New consequence reducer
			-		0	Reuse consequence reducer
	-					
	Compute Risk Level					
	Record					
	(beer)					
	//					
I						
	~					



The analysis is repeated for each initiating event, until the practice is completed.

FORO SEVRRA Foro iberoamericano de Orga Reguladores Radiológicos y N			
Start Practice	es My Account	About SEVRRA	Help Exit
Service=>Linear Accelerator	Location=> Linear Accelerator/Stage 2/Substage 4/In	itiating Event 1	
• Stage 1: Initial setup of the equipment		Initiating Event	Does the
Stage 2: Acceptance and Commissioning	Code: AL-PAC2.28		initiating event Apply in your
$_{\oplus}$ Substage 1: The LINAC. With consequ	Name: Interconnection problems affecting the e	lectronic data transfer from the TPS to the accelerator 😐	service ?
Substage 2: Planning System (TPS). W	Description:		Yes No
QRH=> IE-1: Erroneous geometric (Consequences:		
RM=> IE-2: Erroneous configurati	Help references:		Risk
QRM=> IE-3: Erroneous wedge con			FL PH CVH = RH
RM=> IE-4: Erroneous configuration			
QRM=> IE-5: Erroneous configuratio			
QRM=> IE-6: Erroneous beam char	Comment and modification proposals list		
QRM=> IE-7: Input of conversion co			
QRM=> IE-8: Input of erroneous fiel	Select from the list below, those barriers and reducers	that are implemented in your facility:	
New Initiator Event	5	B arrations	
Substage 3: Image Acquisition equipm	Frequency Reducers	Barriers	Consequence Reducers
QRM=> IE-1: Incomplete commissic	Training of the physicist, that includes the entire TPS commissioning process, the tests to be performed and related	Comparison of TPS calculations results for tests cases against direct phantom measurement during TPS	Weekly in-vivo dosimetry by which dose delivery errors can be detected 2
New Initiator Event	lessons learned 🕜 🔍	commissioning 😢 🔍	Weekly portal image, with which geometric errors can be
Substage 4: Transfer System TPS-LINA		In-vivo dosimetry in initial treatment session, to verify the	detected 🛛 🔍
SIE-1: Interconnection problems aff		delivered against the planned doses, which allows for error detection in dose delivery 2	At the daily patient setup, the radiotherapy technologists can
New Initiator Event		Verification of the treatment plan data transferred to the	detect geometric or dose errors by visual signs, such as skin reddening, etc. 2
Substage 3: Equipment maintenance.		accelerator 😢 🔘	QA tests of the TPS (daily, weekly, monthly, quarterly and
⊕Substage 1: With consequences for pat ⊕Substage 2: With consequences for rac	New frequency reducer	Portal image taken during the initial treatment session for evaluation by the radiation oncologist and the medical	annually). When a significant inconsistency is detected,
⊕Stage 4: Treatment Clinic Prescription	Reuse frequency reducer	physicist, whereby geometric treatment errors can be	treatments are stopped 😵 💿
Stage 5: Patient anatomical data acquisitic		detected 😢 💭	treatment delivery or from previous stages ?
		Commissioning tests for the transfer system. Visual	
	Sistema de Evaluación del Rieson e	n Radioterania - SEVRRA 3.0 (English Versión, DRAFT)	,



ADD BARRIERS AND REDUCERS

Users have the option to improve the analysis by adding barriers, reducers and initiating events.

FORCO SEVRRA Foro iberoamericano de Organismos Reguladores Radiológicos y Nucleares				
Start Practice		About SEVRRA		Help Exit
Service=>Linear Accelerator	Location=> Linear Accelerator/Stage 2/Substage 4/Initiating Event 1			
Stage 1: Initial setup of the equipment		Initiating Event		Does the initiating
Stage 2: Acceptance and Commissioning	Code: AL-PAC2.28			event Apply in your service ?
©Substage 1: The LINAC. With consequences for the patien	Name: Interconnection problems affecting the electronic data t	transfer from the TPS to the accelerator		Yes No O
Substage 2: Planning System (TPS). With consequences fo	Description:			Yes No O
RH=> IE-1: Erroneous geometric configuration of the a	Consequences:			Risk
RM=> IE-2: Erroneous configuration of the multileaf or	Help references:			FL PH CVH = RH
QRM=> IE-3: Erroneous wedge configuration into the T				L PR CVN - RH
RM=> IE-4: Erroneous configuration of conformal shie				
QRM=> IE-5: Erroneous configuration of compensators	Comment and modification proposals list			
QRM=> IE-8: Erroneous beam characterization data an	Comment and mounication proposals list			
QRM=> IE-7: Input of conversion coefficient to convert I	Select from the list below, those barriers and reducers that are implemen	ited in your facility:		
RM=> IE-8: Input of erroneous field factors on the TP.	· · · · · · · · · · · · · · · · · · ·			
New Initiator Event	Frequency Reducers	Barriers		Consequence Reducers
Substage 3: Image Acquisition equipment. With conseque	Training of the physicist, that includes the entire TPS commissioning process, the	Comparison of TPS calculations results for tests cases against direct phantom	Weekly in-vivo dosimetry	by which dose delivery errors can be detected 😢 🔍
RM=> IE-1: Incomplete commissioning of the CT equi	tests to be performed and related lessons learned 😢 👄	measurement during TPS commissioning 🚷 👄	Weekly nortal image with	h which geometric errors can be detected 🕜 👄
New Initiator Event		In-vivo dosimetry in initial treatment session, to verify the delivered against the planned doses, which allows for error detection in dose delivery 🖓 👄		, the radiotherapy technologists can detect geometric or dose
G- Substage 4: Tennis Sector TPS-LINAC. With consequen		Verification of the treatment plan data transferred to the accelerator 0 0		ch as skin reddening, etc. 2
E-1: Interconnection problems affecting the electronic	(y, weekly, monthly, quarterly and annually). When a significant
New Initia confivent		Portal image taken during the initial treatment session for evaluation by the radiation oncologist and the medical physicist, whereby geometric treatment errors can be		, treatments are stopped 😢 💿
Stage 3: Equipment no intenance.	New frequency reducer	detected 😢 👄		on of the patient can detect errors in treatment delivery or from
Substage 1: With conservances for patients	C Reb Conterreducer	Commissioning tests for the transfer system. Visual verification of the electronically	previous stages 🛛 🔍	
⊕Substage 2: With consequences for radiation workers	Nº Y	transferred data 😢 👳		
Stage 4: Treatment Clinic Prescription				
Stage 5: Patient anatomical data acquisition				
Stage 6: Volume delineation	· ·		- New control sector	or
Stage 7: Treatment Planning		All New Res	Reuse concerner enter	Joer
Stage 8: Preparation of molds		C Reuse Ballier		
Stage 9: Beginning of treatment		V Redse Baren	<u> </u>	
Stage 10: Positioning for daily treatment	Compute Risk Level		~~	,
Stage 11: Implementation of treatment	Compare rust cever		•	
		V		



FACILITY RISK PROFILE

As the analysis is completed, the risk profile of the facility will be outlined:

FORO SEVRRA Foro iberoamericano de Organismos Reguladores Radiológicos y Nucleares Start Practices	s My Account			About SEVF	RRA		1	Help	Exit
Stage 2: Acceptance and Commissioning	Service Summary (Initiating Events)								Report
Stage 3: Equipment maintenance.	Num. Stage	Risk Very High (RVH)	Risk High (RH)	Risk Medium (RM)	Risk Low (RL)	Not Apply (NA)	Recorded	Total by Stage	Completed
Stage 4: Taking data from each patient for treatment planning		0		9	1	0	10		
Example 2: Development of treatment plan Example 2: Development of molds. Consequences for Patients wi	2 Acceptance and Commissioning	0		20		0	24		
Stage 6: Development of molds. Consequences for Patients with Stage 7: Implementation of treatment	3 Equipment maintenance. 4 Taking data from each patient for treatment planning	0		3	0	0	3		
	A Taking data from each patient for treatment planning S Development of treatment plan	0		(1		20		· · · · ·
	6 Development of molds. Consequences for Patients with	0		3	0) 20	3	
	7 Implementation of treatment	0	14	34	8	0	56		
	Total User:	0	42			0			
	Total Reference:	ŏ	5	80 87	10 40	ŏ	132 132	132 132	ò
		Curr	ent Service vs. R	deference Service					
2	Current RH 32% Service Co-60 RM 61%	RL			R	Reference			×



COMPARISON WITH REFERENCE FACILITY

Once completed, the user can see in a summary report the result of his analysis, comparing it with that of a reference facility FORO FORO iberoamericano de Organismos Reguladores Radiológicos y Nucleares

3. Risk Assessment Results

3.1 Summary

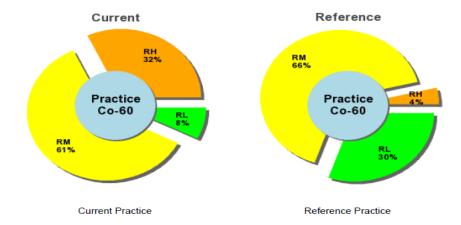
The risk assessment results indicate that taking into account existing safety barriers, frequency and consequences reducers in your Radiotherapy Service, the next risk levels has been reached for initiating events by stage:

Num.	Stage	Risk Very High (RMA)	Risk High (RA)	Risk Medium (RM)	Risk Low (RB)	No Apply (NA)	Analyzed	Total by stage	Complete
1	Initial setup of the equipment	0	0	9	1	0	10	10	I
2	Acceptance and Commissioning	0	4	20	0	0	24	24	S
3	Equipment maintenance.	0	0	3	0	0	3	3	I
4	Taking data from each patient for treatment planning	0	8	7	1	0	16	16	I
5	Development of treatment plan	0	16	4	0	0	20	20	I
6	Development of molds. Consequences for Patients with	0	0	3	0	0	3	3	I
7	Implementation of treatment	0	14	34	8	0	56	56	0
Total User: Total Reference:			42 5	80 87	10 40	0	132 132	132 132	7 0

Incorporated Sequences by User:

Núm.	Stage	Risk Very High (RMA)	Risk High (RA)	Risk Medium (RM)	Risk Low (RB)
1	Initial setup of the equipment	0	0	0	0
2	Acceptance and Commissioning	0	0	0	0
3	Equipment maintenance.	0	0	0	0
4	Taking data from each patient for treatment planning	0	0	0	0
	Development of treatment plan	0	0	0	0
6	Development of molds. Consequences for Patients with	0	0	0	0
7	Implementation of treatment	0	0	0	0
	Total	0	0	0	0

3.2 Graphics: Current Practice vs. Reference Practice





FINAL REPORT

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 (RVH):

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.

IE Code	Initiating Event	Reference Risk	Calculated Risk	Missing Barriers and Reducers
Co60-PAC2.1	Error in the calibration coefficient of the ionization chamber and electrometer (in the standards dosimetry laboratory).		RH	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 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
Co60-PAC2.16	Error in recording data measured during commissioning, for input to the treatment planning system (TPS)		RH	B-277: Redundant verification of the records by another medical physicist CR-357: Daily patient setup wherein the radiotherapy technologists can detect errors of geometry or dose by observing visual signs on the patient (skin reddening, etc.) CR-377: At the weekly medical evaluation of the patient, errors in treatment delivery can be detected
Co60-PAC2.17	Incorrect generation of data tables for manual treatment planning (for example, depth dose curves)		RH	B-277: Redundant verification of the records by another medical physicist CR-339: 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
Co60-PAC2.24	Incomplete commissioning of the CT equipment, leading to errors in the density and geometric scales		RH	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 wherewith geometric errors can be detected CR-377: At the weekly medical evaluation of the patient, errors in treatment delivery can be detected



AID FOR EVENTS AND BARRIERS

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.

Forei bereamericano de Organismos Reguladores Radiológicos y Nucleares			
Start Practices	· · · · · · · · · · · · · · · · · · ·	About SEVRRA	Help Exit
Service=>Cobalt 60	Location=> Cobalt 60/Stage 1/Substage 1/Initiating Event 1		
Stage 1: Initial setup of the equipment		Initiating Event	Does the initiating event Apply in your
Substage 1: With consequences for patients QRL=> IE-1: Deficiency in the manufacturing process c	Code: Co60-PAC1.1		service ?
QRL=>IE-1: Deliciency in the manufacturing process c QRM=> IE-2: Supply of a wrong source	Name: Deficiency in the manufacturing process causing an inhomogen	eous distribution of 60Co radioactive material in the source 🤍	Yes No O
QRM=> IE-2: Supply of a wrong source QRM=> IE-3: Error in the manufacturer's source certific	Description:		
RM=> IE-3: Erform the manufacturer's source default @RM=> IE-4: Incorrect source alignment	Consequences:		Risk
QRM=> IE-5: Significant variations in the source transit	Help references: Lessons learned from acci	dents, Safety series, Safety Reports,	FVL PVL CH = RL
New Initiator Event			
Substage 2: Consequences for radiation workers.			
Substage 3: With consequences for the public	Comment and modification proposals list		
Stage 2: Acceptance and Commissioning			
Substage 1: Teletherapy equipment. With implications for	Select from the list below, those barriers and reducers that are implement	ted in your facility:	
Substage 2: Treatment Planning System (TPS)	Frequency Reducers	Batters	Commence Bacharan
⊕Substage 3: Image Acquisition System (CT).			Consequence Reducers External audit. Physics aspects: auditing procedures for measurement of dose rate and
Stage 3: Equipment maintenance.	Purchase of sources only from recognized manufacturers 🔮 🖲	Treatment planning of test cases on the TS and comparison with direct measurements, as part of TPS commissioning 0 @	External audit. Physics aspects: auditing procedures for measurement of dose rate and beam flatness control for some randomly selected fields 🔮 🔍
Stage 4: Taking data from each patient for treatment planning		Acceptance test: control test of dose rate, beam symmetry and flatness for specified	
Stage 5: Development of treatment plan		fields 🔮 🔍	
Stage 6: Development of molds. Consequences for Patients wi		Commission Letter control of doce rate and flatness or all fields 🔮 🔍	
Stage 7: Implementation of treatment	New frequency reducer	modification	
	Reuse frequency reducer	proposal	New consequence reducer
			. O Reuse consequence reducer
		New Barrier	
		C Reuse Barrier	
	Compute Risk Level		
	Compute Risk Level		≨ safety
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			Li monte para da la construire a la construire da la cons
			(5) инициальные накональные накональные накональные накональные накональные накональные накональные накональные
			Safety Reports Series
			No.7
			LESSONG LEARNER -
			ACCIDENTS IN NO USERTS IN
			H-DRUGRAPHY



