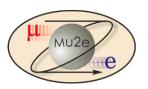
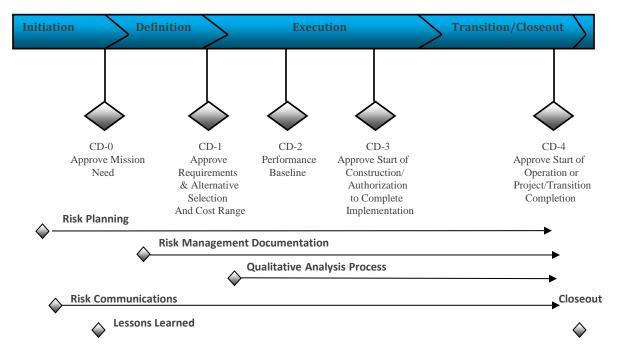


Risk Management Conventional Construction



T. Lackowski L2 Manager 10/22/2014

RISK MANAGEMENT DURING CD PHASES



Critical Decision Phases with continuous and iterative risk management.

🛠 Fermilab

10/22/2014

KEY ELEMENTS OF RISK MANAGEMENT

- 1. Risk Planning
- 2. Risk Identification
- 3. Qualitative Risk Analysis
- 4. Quantitative Risk Analysis
- 5. Risk Handling and Mitigation Strategies
- 6. Risk Monitoring



Mu2e

Risk Identification

- Identified and documented Risk items.
- Clearly state the risk event and impact to the Project.
- Note the interdependencies within the Project.
- Compile and review risks at the subproject level, then submit to Project Office.
- Project Manager determines which risks are above threshold that will be held in the Project Risk Registry"
 - Currently, Mu2e Risk Register contains two Conventional Construction risks that are held by the L2 and one risks that are held by the Project Manager.
 - Lower level risks are held by the Conventional Construction L2.

5 Fermilab

10/22/2014



Risk Analysis Tools Qualitative

Impact Risk	Very Low	Low	Moderate	High	Very High
Cost	< \$50K	\$50K - \$100K	\$100K - \$250K	\$250K - \$500K	> \$500K
ES&H	Negligible	Minimal	Concern	Significant risk	High risk
Schedule	Delays Level 3 milestone or Project critical path by < 1 month	Delays Level 3 milestone or Project critical path by 1 - 3 months	Delays Level 3 milestone or Project critical path by 3 - 6 months	Delays level 3 milestone or Project critical path by 6 – 9 months	Delays Level 3 milestone or Project critical path by > 9 months
Technical	Negligible	Negligible, if any, degradation.	Significant technical degradation.	Technical performance effectively useless for attaining physics objectives.	Technical performance useless for attaining physics objectives.

Table 1: Impact Assessment Matrix. Impacts range from Very Low to Very High.

Table 2: Risk Classification Matrix

	Impact							
Probability	Very	Low	Moderate	High	Very			
	Low				High			
Very High (> 90%)	Low	Moderate	High	High	High			
High (75% – 90%)	Low	Moderate	Moderate	High	High			
Moderate (25% - 75%)	Low	Low	Moderate	High	High			
Low (10% - 25%)	Low	Low	Moderate	Moderate	High			
Very Low (< 10%)	Low	Low	Low	Low	Moderate			

Impact Risk	Very Low	Low	Moderate	High	Very High
Cost	< \$50K	\$50K - \$100K	\$100K - \$250K	\$250K - \$500K	> \$500K
ES&H	Negligible	Minimal	Concern	Significant risk	High risk
Schedule	Delays Level 3 milestone or Project critical path by < 1 month	Delays Level 3 milestone or Project critical path by 1 - 3 months	Delays Level 3 milestone or Project critical path by 3 - 6 months	Delays level 3 milestone or Project critical path by 6 – 9 months	Delays Level 3 milestone or Project critical path by > 9 months
Technical	Negligible	Negligible, if any, degradation.	Significant technical degradation.	Technical performance effectively useless for attaining physics objectives.	Technical performance useless for attaining physics objectives.

Table 1: Impact Assessment Matrix. Impacts range from Very Low to Very High.

Fermilab

Mu₂e

10/22/2014

Project Risk Form

Mu2e Risk Form

Risk Identifier:	T. Lac	kowski			Risk Owne	r: T. Lacko	owski		
Risk ID:	CONS	T-050			Risk Type: THREAT				
Date:	11/1/2013				Date revise	ed:			
Risk Descript project reque Detailed Risk Detailed Risk	on: Th sts pro Cause Effect	e world, nation oposals for con : High demand	struction are iss d for constructic	truction marl ued. n services.	ket experie		umes of work at the		
looking for w WBS Affecter									
Other WBS A	fected	1:							
Actual Start I (when availa from schedul	ole	Actual Fini (when avai schedule)							
nom seneau									
FY14 Initial Risk complexity): pricing on ge	Since neral c	ysis – (descri 2008 a depress construction. V	sed overall econ Vill obtain propo	omy has resu osals prior to	lted in mo Baseline C	re competitio D-2 review. S	ngth commensur n between contra ince 2008 a numb the number of int	ctors lowering er of	
FY14 Initial Risk complexity): pricing on ge contractors i contractors a	Since neral c ave be nd lea	ysis – (descri 2008 a depress construction. V een forced out ding to increas	ption of selectic sed overall econ Will obtain propo of business due sed costs.	omy has resu osals prior to to the compe	lted in mo Baseline C etition, pos	re competitio D-2 review. S ssibly limiting	n between contra	ctors lowering er of erested	
FY14 Initial Risk complexity): pricing on ge contractors i contractors a	Since neral c ave be nd lea obabi	ysis – (descri 2008 a depress construction. V een forced out ding to increas ity and Impact Initial Schedule Impact Delays Level milestone or roject critical path by) in days	ption of selectic sed overall econ Will obtain propo of business due sed costs.	Initial C (VH,H,M,	Risk Mana Risk Mana Risk U U VVI	re competitio D-2 review. S ssibly limiting	n between contra ince 2008 a numb the number of int	ctors lowering er of erested	
FY14 Initial Risk complexity): pricing on ge contractors i contractors of Initial Risk P	Since neral c ave be nd lea obabi	ysis — (descri 2008 a depress construction. V een forced out ding to increas lity and Impac Initial Schedule Impact Delays Level milestone or roject critical path by) in	ption of selectic sed overall econ Vill obtain prope of business due ed costs. t scores selectee If HIGH SCHEDULE IMPACT, Upper Bound of Current Schedule	Initial C (VH,H,M,	Ited in mo Baseline C etition, pos Risk Mana ost U V,VL)	re competitio D-2 review. S ssibly limiting agement Plan HIGH COST IMPACT, pper Bound of Current Cost impact	n between contra ince 2008 a numb the number of int (Mu2e-doc-461) Initial Scope Impact	ctors lowering er of rerested Tables 1 and 2 Initial ES&H and Quality Impact	
FY14 Initial Risk complexity) pricing on ge contractors i Initial Probability (VH,H,M, L,V <u>M</u> Exposure (M 10% of estim Initial Risk P	Since neral c ave be nd lea obabi ((3 ((1 (1) p (1) (1) p (1) hat th ated c itigati	ysis — (descri 2008 a depress construction, V. een forced out ding to increass lity and Impact Delays Level milestone or roject critical path by) in days VH,H,M,L,VL) N e risk will cost onstruction co on Plan consid	ption of selectic sed overall econ Vill obtain propu- ed costs. t scores selecter If HIGH SCHEDULE IMPACT, Upper Bound of Current Schedule Impact (Days) when it occurs) st. \$1,200,000 p	omy has results sals prior to to the compu- l from MuZe Initial C Impace (VH,H,M, VH : us 3months 1 a Risk Analya	Ited in mo Baseline C etition, pos Risk Mana ost U t V,VL) C for change sis and inc	re competitio D-2 review. S ssibly limiting agement Plan HIGH COST IMPACT, pper Bound of Current (\$) \$1,200,000 : control.	between contra ince 2008 a numb the number of int (Mu2e-doc-461) Initial Scope Impact (VH,H,M,L,VL) N Sase Plan Cost and	ctors lowering er of Tables 1 and 2 Initial ES&H and Quality Impact (VH,H,M,L,VL N d Schedule:	
FY14 Initial Risk complexity); pricing on ge contractors : Initial Probabilit; (VH,H,M, L,V M Exposure (M 10% of estim Initial Risk P	Since neral c ave be nd lea obabi (3 (1 L) p ((1 (hat th tated c itigati	ysis – (descrit 2008 a depress construction, L sen forced out ling to increas lity and Impact Delays Level Impact Delays Level	ption of selectic sed overall econ Vill obtain propu- ed costs. t scores selecter If HIGH SCHEDULE IMPACT, Upper Bound of Current Schedule Impact (Days) when it occurs) st. \$1,200,000 p	Initial C Initial C	Ited in mo Baseline C etition, pos Risk Mana ost U t V,VL) C for change seand inc constructio	re competitio D-2 review. S sisibly limiting agement Plan HIGH COST IMPACT, pper Bound of Current (\$) \$1,200,000 control. duded in the I on market than Start ription of Cur	n between contra ince 2008 a numb the number of int (Mu2e-doc-461)" Initial Scope Impact (VH,H,M,L,VL) N	ctors lowering er of Tables 1 and 2 Initial ES&H and Quality Impact (VH,H,M,L,VL N d Schedule: recovered.	

(Accept, Reduce, Avoid, Transfer)			New or Additional Mitigation Cost Range (\$) Low Bound Upper Bound			Schedule impact of undertaking the mitigation plan – delays Level 3 milestone or project critical path (Days) Lower Bound Upper Bound				Probability of plan failing to achieve expected mitigation (H,MH,ML,L)	
Accept				opper bound							
Residual/Curre	nt Risk Prol	ability	and Impa	act Scor	es:						
Residual/ Current Probability (VH,H,M, L,VL)	Residual Schedule Impact (Delays Level 3 milestone or project critical path (Days) (VH,H,M, L,VL)		Upper Bound Im of Residual (VH,H, Schedule Impact (Days)		aal Cost pact M, L,VL)	If HIGH COST IMPACT, Upper Bound of Residual Cost Impact (\$)		Residual Scope Impact (VH,H,M, L,VL)		Residual ES&I and Quality Impact (VH,H,M, L,VL	
L Additional Note	N		v		/н		N		N		
			timate Point es e-days) (proba		oint esti probabi			CTATI UE IN			ATION VALUE IN Days
\$1200k		1,012,000	60		10%		\$120k			6	



6 T. Lackowski DOE CD-2/3b review

Lower Level Risks

- Project level risks were generated from the sub-project risk registry.
- Lower level risks are reviewed monthly at the sub-project level.



Potential Problem	Prikaldky	Impact	Seculy	Type		Likely Causes	Consequence	Milgitko	
1967 3122 5	1000	1000	133634	133	1000	1000	10000000	101 March 10	C. 1988
Statigate FEDDRAG	Moderals	Modente	Moderate	C, 2, 7	T. Laderviki	Cab ruteagenet destruiet to other FEA grojeda	Region ARX conta, shown development of project	Accellente efforte and produition of économic believ other projects become	
Allowed .							documents		Ratired - Docum complete
Design Development Late	Modente.	Modente	Modents	8	T Laderwski	Development of Oriters for Technical Equipment late for	Project concess tot property streaded, project	E7bilish schedule requirements, Employ EVMII on Add contrast	
						prigott scheikale	delays		Patried
Convened diversing requirements	Moderate	Modente	0.55 dente	C, F	T. Ladiowski	Starbing requirements so rease requireing larger convertions' without Devoture	Deeper Recordion / Additional Deputate	Beam Kawgy lowwed from 25 to 0.5470 Manitals communications with from establishing shielding orders	Retired - Preim Radiation Asses
Transfel - Parisonal	Modente	Tigh	20	C. #	T. Laufane da	addamal Drotture Technical Regurements	Duilding in traiter m size	establishing shielding orders	Approved
Sciencialic Equipeneral Surrense in Damenico	Accessor	into .	inter .	4.0	1. 1900.4.00	inguidratly increase desenation of englishing increases desenation of efforts area	and cost	Did has clearly stated that the experiment will used to charge to its building	0.000
High Radiation Douros	Low	High.	Modents	C,E	T Latitur Rt	Occupitivater Protection	Reparecaddoceal		Patred - Preim Patred - Preim Patroon Asses
100000000000000000000000000000000000000	212	100	0.0000	100	2 HEROSOFT	Representation	Requireculdblocal docting		Fladiotion Assess Approved
Dengn Development Late	Low	Modente	Moderate	C, 2	T. Laterwicki	Panch not available for design development or funds arrive too	Final deing late m starting	Entitlethed requests then ofter LCs is tobulate, reported on progress at weakly left heard meeting Cleansy of other to allow construction to present	
								leth board meeting	Retired - Comp
EX mused	Low	Rept	SSo-Senite	C, 8, 8	T.Ledowski	2de deleasation fields Hatarilious wait or environmental import	High impact code for clearup with schedule and prend fillings	Cleanap of one to allow construction to proceed	
				-			perod fillings		Retired - NEPA I
Unforecess/Undocumented Subcurface Conditions	2.09	36008324	anoosees.	C I	1. Laberd del	Pockets of unstable solid, or large boulders	Charms and delays in eccentration activities	Dengs foundation system to tridgepoor tools,	Ongoing - Borin program comple
d alety Incolent.	Low	15 gh	boolerate	8, 8	T. Lockowski	Eignaficant listory or Death	itop Woit Flacel, Tgor A or S membralism		Rick Transferroc Project Manager
Orgoing Operational Constraints	Molente	Modenite	Moderate	8	T. Laderwski	The contractor does not get catagot or too marat caloridad The AE or GC substatut a substatual class	Improved construction.	Ohibies are being roated around the project	
Outstand Of Contractor Outstand Claim	Moderate	Moderate	2.40-dengte	c	T. Ladowiki	The AE or GC tuberity a	Addatated outstant out	Monitor contractor activitiest closely during out of scope work	Patrico
Substantial Claim	Moderate	Maderala	No. Augo	0.0	T. Lautone (k)	nd-metal clean	Costs exceed available	cat of scope wate	Accept
Contraction Market - Materials & Labor - Deamalability Of		No. of Street,		1.0	1. 1.00.0010 (41	The world, national, or local construction market, in	Sup da		
Babontesches/Contraction Workforce-Propouls are			1			experiencing high volumes of work at the time five project.			
Horkforce-Proposids are			1			reparato proposalo for construction (at may notar i.t.			
			1			reparts proposals for construction (at may score its response to efforts to standate the world emorray)			
Construction Market -	Modents	Modeni+	Moderate	0.0	T. Latitry (k)	The world national or local	-		Accept
Construction Market - Proposal it Come In Low				1.0	- Lincer V Oci	The world, national, or local construction market in			
			1			experiencing low volumes of work at the targe the project			
			1			requests proposals for construction			
Requirement Changes	Low	Modente	Souderate .	C, 5, 7	T. Latin viki	The Doombilis Requirements	Distribution scope and cost.	Place building dengs under drange centrol	Accept Fisk transferred
Delay In -Critical Decision	Modemie	Moderate	historia	0	7.1 actions (k)	Change	Schekzle-delay, cost		Poik transferred Project Manage
Tield Depart Tuday				1		CD-2 and CD-1 approval taken longer that scheduled	excalition.		Accept
Field Pernat Delays	Line	Modente	Moderate	8	T Lockswiki	E-ty permits (Lig permit, Etate of Elizois an brater, etc.) are not	Delay exploration start	Obtain permits surly	
	Motente	Modente		-		origen som someone Keip periode slag periode, Etabe of Elimote andvater, etc.) are not poorte af antigae folger oppgenent/trademid to delar eved late or damaged	Deberkale deby	Monitor solenatala	Substantially Re
Late Equiperant/Material Delatement By GrC	Motente	Modeste	Moderate		T Laderwicki	delia ered lide or darraged		04 9/05 1707 - C 447	Acospt
Owner-Cascel Delays	Low	Low	Liv	C, 2, 1	T. Lodowski	perior errol late or damagned Ederformisen from side operational er ober construction after fors, etcomines deuge changes, delayed business operations (delayed pagements, presida and construct	Clarge and otherate delays	Connext and Compliance enter has provided notification, presentations to 9247 from Operations Delivery Ring dist down	
			1			ador forz, shownine dough	and a	Fess Operations: Delivery Ring abut down	
			1			openbora (delayed payments,			
			1			and doubled cause media due			
			1			mpacta	1		accept
Derges Phase Construction Extended Are Higher Than Budgeteil	Moderate	Modente	56)denite	C	T.Ledewski	The estimates are higher than Project baseline estimate	Will need to reduce scope	Perform early extensite and revue design if avoid	
Enderted									Fatirod
Dapport Contribut Adequately Emploided	Low	Low	C.CV	C	T. Ladoviki	Costs of apport by Persila's apport props po over the agreed budget.	Scower costs	Code accluded for utility located, narrey and alignment and PESS Operations	
	Moderate			_		agreed budget			Accept
Changes Or Lonner Key Personnel	Moderate	Modente	Moderate	8,T	T. Ladirovski	The project team has a tamover of key personnel	Lotte deigs cottinuty		Accept
Additional Dupport Costs Due To Delays	Moderate .	1.00	2.00	C,8	T. Laderwski	Contrastion exects/beyond the current robeliated completion.	Cost overna		1000
									Accept
Design-Chinges	Moleste	Moderate	bóyderate	C. T	T Lectowski	Customer causes a delevationary change or sebancement in the	cost is ever and other kills delay	Pace design under change control	
						approved design late in the focus place.	- 22		1997
AT Design Team (Dariger Or Loses Key Personnel	Moderatie	Modente	Moderate	0,8	T Latinovski	The AE decign team has a tamor or of key personnel.	schedule-delay	After correlation of documents some of the	evenined
Or Loss Key Personnel	2265293			1000	100000000			AikE team have left (Coult Mechanical)	accent.
Feal Design Delayed	Modenie	Modeste	2.6x3erda	8	T. Ladowski	The AE design leases does not	Schedule delay		100.001
	Moderate	Moderate	historia.	c	T Latery &	The AE design leases down not deliver the final design on toyat There are entry and omittions in	Clans, dischallor	Design reviewed lating moreal assesser	Patried
Servers & Organization In		1		Ê.		the design The processional process	perviceat-lity fielane	Design reviewed using neveral average, A.B.E. readed contract, documents	Accept
Arron & Onorions Is Delign By A-E									
Errore & Onumions In Design By A-8 Dolay In Procurement Approval Process	Molente	Moderate	2doderate	C, #	T Ladiowski		Schekke Jelay		
Design By A-E Dolay In Procurement Approval Process	Molente	Moderate	Moderate	C, B	T Lackow (k)	emensmon approval delays that take longer than normal		Brading payonal Shortsenation	Accept
Design By A.E Dolay In Proceedent Approval Process Contractor Extended Canonic Contractor Work	Molente Lov	Modeoite Righ	Moderate Moderate	C, 8	T Ladowiki T Ladowiki	organistics approval delays that take longer than normal An instipation of or weak medicarish is collected instead of	Di beskie delay Di beskie delay	Bonding repared, Procurement made finanial assessment	Accept
Design By A-E Delay In Proceeded Approval Process Contractor Educted Canon Complete Work Satisfactority Or Defaults On Contract	Molenie Low	Modenite Righ	bdoderate Ddoderate	C, 8 C, 8	T. Ladove (k)	experience approval delays that take longer than normal An instrumented or weak readoritab is selected (award of contract)	Bolivézős Gelay	Fatariasi accessitienti	Accept
Design By A-E Delay In Proceeded Approval Process Contractor Educted Canon Complete Work Satisfactority Or Defaults On Contract	Moleste Low	Moderate Righ	bdoderate bdoderate	0,8 0,8 7	T Ladovráti T Ladovráti T Ladovráti	experience approval delays that take longer than normal An instrumented or weak readoritab is selected (award of contract)	Bolivézős Gelay	Bronking required, Procurement made feacual assessment. Plan reader adulty out of encoration.	Accept Accept
Denign By A-8 Dolay In Proceeding Approval Process Computer Extended Canon Complete Work Categories for Categories Co	Molente Low Low	Moderate Ruga	Moderate Moderate	с, в с, в		equencies approval delay that take tenge than normal has receptions or weak resiliaritable in selected (proved of contract). The contractor breaks or damager a shifty system Emersore due, i pressure, or		Fatariasi accessitienti	acomt
Design by A-E Delay in Proceedings Constructor Editorial Constant Constructor Editorial Constant Constant Statisticstrofy Or Defaults On Constant Disruptions To An Perculab Tacility	Molente Low Low	Modente Rigk Low	Moderate Moderate	C, 8 C, 8 7		equencing approval didge fast tion longer han normal. An interpretation of result fundationals in infected (among of contract). The contraction breaks or damagers utility system. Economic data, of features, or fusion created.	Bolivézős Gelay	fearer a construct	Accept accept
Design By A-E Delay In Proceeded Approval Process Contractor Educted Canon Complete Work Satisfactority Or Defaults On Contract	Low Low	Modente Bigh Low Modente	Moderate Moderate Moderate	C, 8 C, 8 T C, 7		expension approval department the target then normal An interpretation of result instational in infected (second of contract). The conductor breaks or damagers utility system. Essensive dust, i theations, or incorrented. CS: duble state matters does	Bolivézős Gelay	Fatariasi accessitienti	accept Ratired
Design by A-E Delay In Processes Approxil Torons Computer Edicated Cases Statisticanty Or Defaults On Computer Work Designment To an Prensib Tacitity CTID: Chilled Water States	Moleste Low Low	Moderate	Moderate Moderate Moderate	0,8 0,8 7 0,7		expensions approval didge fast, their Scoper Boost normal. An respersion of er weak numbership is indecided (served of contract). The contraction breaks or damager a stating system, damager a stating system. Encourse data, is indexized, or near containd. Clift databat stater system does not also particle stater system.	Bolivézős Gelay	Instant associated	accept Ratired
Design by A.B. Onling In Processmont Approval Drocess Complete Weit, Sandschröf Vor Defaults On Complete Weit, Sandschröf Vor Defaults On Dengenen To An Petrolish- Taxing CTIB: Chilled Wolfer Stytters Insfegante 2029 System Insdergate	Los Los	Low Modente Modente	Modemie	C, 8 C, 8 C, 7 C, 7 C, 7	T. Lacione da T. Lacione da	equences approval datap that his frager than summal An exceptement of weak measured a context of annual of contract). The contracture breaks of manager within yettem. Elements with any yettem Elements of the strategy of the second of the strategy of the formalis CNM documents is equally provide CNM documents is equally provide CNM documents is equally provide and any other strategy.	Belavkile tiday Colil Lensmite Sean m one or more socilientari	Transist addetiment Franzreiden skillig out of microsoften From and capacity in adequate for bodic Promove and flow has been excluded and Promove and flow has been excluded and	accept Retred
Design by A.B. Onling In Processmont Approval Drocess Complete West, Complete West, Comple	Los Los	Love Modende	Modemie	C, 2 C, 2 C, 7 C, 7 C, 7 C, 7	T. Lacione da T. Lacione da	equivariant approval delary that his frager than remain An energenemed or weak neukarda is existential are industrial as existential are industrial. The outpraction freedul or industrial. The outpraction freedul or industrial provides industry weak for main. We descate for emain.	Bolivézős Gelay	Instant associated	Accept Extend Transferred to operations Ratired - IDWn
Design by A-B Design by Proceedings Approval Drocem Connector Educated Canadi Complete Water Satisfactority Or Defaults On Connect Disruptions To An Percentile Tacility CEB Chilled Water System Satisfactority DCPP Dystem Statisfactor DCPP Dystem Statisfactor To Default Attention To	Los Los	Low Modente Modente	Modemie	C, 8 C, 8 T C, 7 C, 7 S, 8	T. Lacione da T. Lacione da	squaresce approval dayp that he reper theorem and an enzymenned or weak multivals in indexid samed at enzymen and a start and manager schult y and hanger schult y and hander schult y and hanger schult y and	Belavkile tiday Colil Lensmite Sean m one or more socilientari	Insuch addetiment Plan moter skilly out of monordium Plan and capacity is a dequate for loads. Document and flow has been as Mantel and most the Properticular sends.	Accept Extend Transferred to operations Ratired - IDWn
Design by A-B Design by Proceedings Approval Drocem Connector Educated Canadi Complete Water Satisfactority Or Defaults On Connect Disruptions To An Percentile Tacility CEB Chilled Water System Satisfactority DCPP Dystem Statisfactor DCPP Dystem Statisfactor To Default Attention To	Los Los	Low Modente Modente	Modemie	C, 8 C, 8 T C, 7 C, 7 S, 8	T. Lacione da T. Lacione da	squaresce approval dayp that he reper theorem and an enzymenned or weak multivals in indexid samed at enzymen and a start and manager schult y and hanger schult y and hander schult y and hanger schult y and	Belavkile tiday Colil Lensmite Sean m one or more socilientari	Insuch addetiment Plan moter skilly out of monordium Plan and capacity is a dequate for loads. Document and flow has been as Mantel and most the Properticular sends.	acompt Padreed Transferred to operations for cooling
Desgrip 24-46 (Selly In Froncesset) Approximation (Selling In Froncesset) Company of Descent Communication Company of Descent Communication Company of Descent Communication Communication (Selling Communication) Communication (Selling Communication) Communicati	Los Los	Low Modente Modente	Modemie	C, 8 C, 8 T C, 7 C, 7 S, 8	T. Lacione da T. Lacione da	equations approach dough that has togget thousanned. An emparamental member and approximate the second part of control. The control of the second part of the second part of the second part of the second part of the second part of the second part of the second part of the second part of the second part of the second part of the second part of the second part of the second part of the second part of the second part of the second part of the seco	Belavkile tiday Colil Lensmite Sean m one or more socilientari	Tenning a strettment Frammeler skiller och of moverdom. Frammeler skiller och of moverdom. Framme and organizer och advantation and andre and frammeler and advantation and andre and advantation sector.	acompt Padreed Transferred to operations for cooling
Desgrip 24-46 (Selly In Froncesset) Approximation (Selling In Froncesset) Company of Descent Communication Company of Descent Communication Company of Descent Communication Communication (Selling Communication) Communication (Selling Communication) Communicati	Los Los	Low Modente Modente	Modemie	C, 8 C, 8 T C, 7 C, 7 S, 8 S, 8	T. Lacione da T. Lacione da	equations approach dough that has togget thousanned. An emparamental member and approximate the second part of control. The control of the second part of the second part of the second part of the second part of the second part of the second part of the second part of the second part of the second part of the second part of the second part of the second part of the second part of the second part of the second part of the second part of the seco	Esterado delay Cool I seconde bran es an or nore accollentiza Much degy age	Insuch addetiment Plan moter skilly out of monordium Plan and capacity is a dequate for loads. Document and flow has been as Mantel and most the Properticular sends.	acompt Padreed Transferred to operations for cooling
Design by A-B Design by Proceedings Approval Drocem Connector Educated Canadi Complete Water Satisfactority Or Defaults On Connect Disruptions To An Percentile Tacility CEB Chilled Water System Satisfactority DCPP Dystem Statisfactor DCPP Dystem Statisfactor To Default Attention To	Los Los	Low Modente Modente	Modemie	0,8 0,8 0,7 0,7 0,7 0,7 8,8	T. Lacione da T. Lacione da	equivalence approved delay the biological parameters of the long the desire of the the long the desire of the the long the desire of the the long the long the long the the long the lo	Esterado delay Cool I seconde bran es an or nore accollentiza Much degy age	Tenning a strettment Frammeler skiller och of moverdom. Frammeler skiller och of moverdom. Framme and organizer och advantation and andre and frammeler and advantation and andre and advantation sector.	acompt Padreed Transferred to operations for cooling
Desgrip 24-46 (Selly In Froncesset) Approximation (Selling In Froncesset) Company of Descent Communication Company of Descent Communication Company of Descent Communication Communication (Selling Communication) Communication (Selling Communication) Communicati	Los Los	Low Modente Modente	Modemie	0,8 0,7 0,7 0,7 0,7 0,7 0,7	T. Lacione da T. Lacione da	regionaria organizati dagi mji postavljan prisovali ovali na karada na kontra da postavljana na karada za postavljana postavljana na karada za postavljana postavljana Da na karada postavljana po	Esterado delay Cool I seconde bran es an or nore accollentiza Much degy age	Tenning a strettment Frammeler skiller och of moverdom. Frammeler skiller och of moverdom. Framme and organizer och advantation and andre and frammeler and advantation and andre and advantation sector.	acompt Padreed Transferred to operations for cooling
Desgrip 24-46 (Selly In Froncesset) Approximation (Selling In Froncesset) Company of Descent Communication Company of Descent Communication Company of Descent Communication Communication (Selling Communication) Communication (Selling Communication) Communicati	Los Los	Low Modente Modente	Modemie	C.B C.T C.T C.T S.E 8.E	T. Lacione da T. Lacione da	representation provide disk of the sector of the sector of the sector of the sector of the sector of the sector	Esterado delay Cool I seconde bran es an or nore accollentiza Much degy age	Tenning a strettment Frammeler skiller och of moverdom. Frammeler skiller och of moverdom. Framme and organizer och advantation and andre and frammeler and advantation and andre and advantation sector.	Accept Patried Trenoferred to Sepretices Resided - IDWrite Resided
Drags by A.d. (Hard) is flowersteat Approach Toward Couples Ward Salandswirk O' Confedence on Couples Ward Salandswirk O' Confedence on Dragstant To an Pressler Training COSS Collect Ward Dynamic Draft Salandswirk O' Confedence on Draft Salandswirk O' Confedence on Draft Salandswirk O' Confedence on Salandswirk O' Confedence on Draft Salandswirk O' Confedence on Draft Sala	Low Low Low Low	Low Modente Modente Modente	Modemie	7 0,7 0,7 8,8 8,1	T Lackowski T Lackowski T Lackowski T Lackowski T Lackowski	regionaria approval delay the provember operation of the the strength model of the the strength model of the strength of the strength of the strength of the the strength of the strength of the strength of the strength of the strength of the strength of the strength of the strength of the strength of the strength of the strength of the strength of t	Stokeksin delay Cool Lemanate Insan as one or nore scontinuity: Murit degy age Delay start of work	There at interfaced Plan review shifty of of second on These and copying is a bayout for basis: Present and form the trees of shared of the second of the second second second Thermitian of the second second second second Thermitian of the second second second second termitian of the second second second second second termitian of the second second second second second second termitian of the second second second second second second termitian of the second second second second second second second termitian of the second secon	Accept Patried Trenoferred to Sepretices Resided - IDWrite Resided
Desgrip 24-46 (Selly In Froncesset) Approximation (Selling In Froncesset) Company of Descent Communication Company of Descent Communication Company of Descent Communication Communication (Selling Communication) Communication (Selling Communication) Communicati	Los Los	Low Modente Modente	Modemie	C.B C.B T C.T C.T R.E R.T	T. Lacione da T. Lacione da	representation provide disk of the sector of the sector of the sector of the sector of the sector of the sector	Esterado delay Cool I seconde bran si an or nore accollentiza Much degy age	Tenning a strettment Frammeler skiller och of moverdom. Frammeler skiller och of moverdom. Framme and organizer och advantation and andre and frammeler and advantation and andre and advantation sector.	Accept Patried Trenoferred to Sepretices Resided - IDWrite Resided
Drogo by A.E. Starg in Province Margin In Province Margin In Province Comparison Forces Margine In Province Margine In Province Margine Internet Internation (CS): CALAR Wave Ty American Margine Internet Internation (CS): CALAR Wave Ty American (CS): CALAR Wave Ty A	Low Low Low Low	Low Modente Modente Modente	Modemie	7 0,7 0,7 8,8 8,1	T Lackowski T Lackowski T Lackowski T Lackowski T Lackowski	experience approved door have province on approved door have an advanced and advanced approved appro	Shi kulor day Natif Instanti Human Inst etanon konfestari Wath days ye Dalay dash di wath Dalay dash di wath Dalay dash di karenan Dalay dash di karena	There at interfaced Plan review shifty of of second on These and copying is a bayout for basis: Present and form the trees of shared of the second of the second second second Thermitian of the second second second second Thermitian of the second second second second termitian of the second second second second second termitian of the second second second second second second termitian of the second second second second second second termitian of the second second second second second second second termitian of the second secon	Accept Retired Transferred to operations Retired - 104 re
Drags by A.d. (Hard) is flowersteat Approach Toward Couples Ward Salandswirk O'Confeduce Counce Couples Ward Salandswirk O'Confeduce Counce Couples Ward Salandswirk O'Confeduce Counce Couples Counce Counce Couples Counce Counce Couples Counce	Low Low Low Low	Low Modente Modente Modente	Modemie	7 0,7 0,7 8,8 8,1	T Lackowski T Lackowski T Lackowski T Lackowski T Lackowski	regionaria approval delay the provember operation of the the strength model of the the strength model of the strength of the strength of the strength of the the strength of the strength of the strength of the strength of the strength of the strength of the strength of the strength of the strength of the strength of the strength of the strength of t	Stokeksin delay Cool Lemanate Insan as one or nore scontinuity: Murit degy age Delay start of work	There at interfaced Plan review shifty of of second on These and copying is a bayout for basis: Present and form the trees of shared of the second of the second second second Thermitian of the second second second second Thermitian of the second second second second termitian of the second second second second second termitian of the second secon	Acomt Patred Transferred Searctions Ratified - 32 for cooling Transferred Managemen



7 T. Lackowski DOE CD-2/3b review

Engineering Risk Assessment

- Assessments were completed by each subproject.

Engineering Risk Assessment

Project: Mu2e WBS 3.0 Conventional Construction Lead Engineer: Lackowski Department: FESS/Eng.

Date: April 30, 2012

Technology

This defines the degree of technical complexity the Lead Engineer or engineering team will face in executing the project.

1 The project will use off-the-shelf technology.

3 Engineers will purchase and modify off-the-shelf technology.

5 The project will require the development of new technology.

Environmental Impact

This defines the potential level of environmental impact.

- 1 There will be no environmental impact.
- 3 The project may have some environmental impact but will not require an environmental assessment, as
- determined by FESHM.

5 The project will require an environmental impact statement.

Vendor Issues

This defines the degree of complexity to be expected with vendors. Complicating factors may include long-leadtime items and issues with vendor qualification and reliability.

- 1 Vendors could cause minor issues.
- 3 Vendors could cause manageable complications.
- 5 Vendor issues could result in significant schedule delays or cost overruns or could otherwise jeopardize the successful completion of the project.

Resource Availability

This defines the availability of internal and external resources to plan and execute the project.

- 1 Resources will be readily available.
- 3 Resources could be somewhat restricted.
- 5 The difficulty of obtaining resources puts the project schedule at high risk.

Quality Requirements

This determines the effort required to achieve the quality level the customer assigns to the final product.

- 1 The quality requirements can be met easily with existing infrastructure.
- 3 The quality requirements are challenging but can be met with existing infrastructure.
- 5 The quality requirements are beyond the capability of existing infrastructure.

Safety

This defines the safety issues the project team will encounter while completing the project.

10/22/2014

k	1

 	100	Per.	

Score

1

3

1

1

3

🛠 Fermilab

1 - Low Risk

3 - Medium Risk

1 - Low Risk

1 - Low Risk

3 - Medium Risk



Mitigations and Monitoring

- Mitigation plans are developed by the risk owner and implemented into the project plan
- The risk owner has a significant role in risk monitoring.
- The risk owner will update information on the risk item's form promptly following recognition.
- After CD-2, the Risk Manager will prepare a monthly report that identifies any and all changes to the Risk Register in the previous month.
- The lower conventional construction risks are reviewed monthly by the owner.



Summary

- Mu2e has a solid foundation of risk entries that all members have agreed on.
- A Risk Management Plan has been developed by the project.
- Mu2e has determined that the Project's Risk Program is acceptable and ready for a CD-2/3b approval.
- Iterative process will continue throughout the life cycle of the Project.
- Both project level risks and sub-project level risks are tracked, and monitored.

