INEEL

IDAHO NATIONAL ENGINEERING & ENVIRONMENTAL LABORATORY

LOCKHEED MARTIN

LOCKHEED MARTIN IDAHO TECHNOLOGIES COMPANY
FAX TRANSMITTAL

Date: 12/9/99

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NOTE/MESSAGE

GLENN: ASP HEPs worksheets.
Remaining HEPs are from THERP.

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SPAR HRA Human Error Worksheet (Page 1 of 3)

#1 Best case

Plant:_____ **Initiating Event:** IE LOC **Sequence Number:**_____ **Basic Event Code:** HEF RECG-Fulstart

Basic Event Context:_____

Basic Event Description:_____

Does this task contain a significant amount of diagnosis activity? YES ☒ (start with Part I, p. 1) NO ☐ (skip Part I, p. 1; start with Part II, p. 2) Why?_____

PART I. DIAGNOSIS

A. Evaluate PSFs for the diagnosis portion of the task.

PSFs	PSF Levels	Multiplier for Diagnosis	If non-nominal PSF levels are selected, please note specific reasons in this column
Available Time	Inadequate time	P(failure) = 1.0 ☐	Time is expansive
	Barely adequate time 20 min	10 ☐	
	Nominal time 30 min	1 ☐	
	Extra time >60 min	0.1 ☐	
	Expansive time >24 hrs	0.01 ☒	
Stress	Extreme	5 ☐	Operator has had alarms, recognizes there is a problem
	High	2 ☒	
	Nominal	1 ☐	
Complexity	Highly complex	5 ☐	
	Moderately complex	2 ☐	
	Nominal	1 ☒	
	Obvious diagnosis	0.1 ☐	
Experience/Training	Low	10 ☐	Assumes a highly trained staff
	Nominal	1 ☒	
	High	0.5 ☐	
Procedures	Not available	50 ☐	Assumes procedures that aid in diagnosis
	Available, but poor	5 ☐	
	Nominal	1 ☐	
	Diagnostic/symptom oriented	0.5 ☒	
Ergonomics	Missing/Misleading	50 ☐	Assumes alarms for temperature and level
	Poor	10 ☐	
	Nominal	1 ☐	
	Good	0.5 ☒	
Fitness for Duty	Unfit	P(failure) = 1.0 ☐	
	Degraded Fitness	5 ☐	
	Nominal	1 ☒	
Work Processes	Poor	2 ☐	Assumes a crew and procedures that interact well in a good facility
	Nominal	1 ☐	
	Good	0.8 ☒	

B. Calculate the Diagnosis Failure Probability

(1) If all PSF ratings are nominal, then the Diagnosis Failure Probability = 10E-2

(2) Otherwise,

	Time	Stress	Complexity	Experience/ Training	Procedures	Ergonomics	Fitness for Duty	Work Processes	
Diagnosis: 10E-2 x	.01	x 2	x 1	x .5	x .5	x .5	x 1	x .8	= 2×10^{-5} Diagnosis Failure Probability

DEC 09 '99 08:31AM SSSSSSSSSSSSSS P.2/11

SPAR HRA Human Error Worksheet (Page 1 of 3)

2 Sensitivity Case

Plant:_____ **Initiating Event:** IE-LOL **Sequence Number:**_____ **Basic Event Code:** HER-RECG-FWSG1

Basic Event Context:_____

Basic Event Description:_____

Does this task contain a significant amount of diagnosis activity? YES ☒ (start with Part I, p. 1) NO ☐ (skip Part I, p. 1; start with Part II, p. 2) Why?_____

PART I. DIAGNOSIS

A. Evaluate PSFs for the diagnosis portion of the task.

PSFs	PSF Levels	Multiplier for Diagnosis	If non-nominal PSF levels are selected, please note specific reasons in this column
Available Time	Inadequate time	P(failure) = 1.0 ☐	Time is expensive
	Barely adequate time 20 min	10 ☐	
	Nominal time 30 min	1 ☐	
	Extra time >60 min	0.1 ☐	
	Expansive time >24 hrs	0.01 ☒	
Stress	Extreme	5 ☐	Operator has observed a problem ex 15's
	High	2 ☒	
	Nominal	1 ☐	
Complexity	Highly complex	5 ☐	
	Moderately complex	2 ☐	
	Nominal	1 ☒	
	Obvious diagnosis	0.1 ☐	
Experience/Training	Low	10 ☒	No training provided
	Nominal	1 ☐	
	High	0.5 ☐	
Procedures	Not available	50 ☒	No procedure available
	Available, but poor	5 ☐	
	Nominal	1 ☐	
	Diagnostic/symptom oriented	0.5 ☐	
Ergonomics	Missing/Misleading	50 ☐	
	Poor	10 ☐	
	Nominal	1 ☒	
	Good	0.5 ☐	
Fitness for Duty	Unfit	P(failure) = 1.0 ☐	
	Degraded Fitness	5 ☐	
	Nominal	1 ☒	
Work Processes	Poor	2 ☐	
	Nominal	1 ☒	
	Good	0.8 ☐	

B. Calculate the Diagnosis Failure Probability

(1) If all PSF ratings are nominal, then the Diagnosis Failure Probability = 10E-2

(2) Otherwise,

	Time	Stress	Complexity	Experience/ Training	Procedures	Ergonomics	Fitness for Duty	Work Processes	
Diagnosis: 10E-2x	.01	x 2	x 1	x 10	x 50	x 1	x 1	x 1	= .1 Diagnosis Failure Probability

DEC 09 '99 08:32AM SSSSSSSSSSSSSSS P.3/11

SPAR HRA Human Error Worksheet (Page 2 of 3)

#1 Beat lose

Plant:_____ **Initiating Event:**_____ **Sequence Number:**_____ **Basic Event Code:** HEP-FW-Start

Basic Event Context:_____

Basic Event Description:_____

Part II. ACTION

A. Evaluate PSFs for the action portion of the task, if any.

PSFs	PSF Levels	Multiplier for Action	If non-nominal PSF levels are selected, please note specific reasons in this column
Available Time	Inadequate time	P(failure) = 1.0 ☐	Time expensive
	Time available time required	10 ☐	
	Nominal time	1 ☐	
	Time available>50 x time required	0.01 ☒	
Stress	Extreme	5 ☐	Problem recognized
	High	2 ☒	
	Nominal	1 ☐	
Complexity	Highly complex	5 ☒	Multiple steps, not routine
	Moderately complex	2 ☐	
	Nominal	1 ☐	
Experience/Training	Low	3 ☐	
	Nominal	1 ☐	
	High	0.5 ☒	
Procedures	Not available	50 ☐	Procedure available
	Available, but poor	5 ☐	
	Nominal	1 ☒	
Ergonomics	Missing/Misleading	50 ☐	Equipment available, well designed and matched to procedure
	Poor	10 ☐	
	Nominal	1 ☐	
	Good	0.5 ☒	
Fitness for Duty	Unfit	P(failure) = 1.0 ☐	
	Degraded Fitness	5 ☐	
	Nominal	1 ☒	
Work Processes	Poor	5 ☐	Crew practiced, conversant with procedures and one another
	Nominal	1 ☐	
	Good	0.5 ☒	

B. Calculate the Action Failure Probability

(1) If all PSF ratings are nominal, then the Action Failure Probability = 10E-3

(2) Otherwise,

	Time	Stress	Complexity	Experience/ Training	Procedures	Ergonomics	Fitness for Duty	Work Processes	
Action: 10E-3	x .01	x 2	x 5	x .5	x 1	x .5	x 1	x 5	= 1×10^{-5} Action Failure Probability

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SPAR HRA Human Error Worksheet (Page 2 of 3)

#2 Sensitivity

Plant:_____ **Initiating Event:**_____ **Sequence Number:**_____ **Basic Event Code:** HEP-FW-start

Basic Event Context:_____

Basic Event Description:_____

Part II. ACTION

A. Evaluate PSFs for the action portion of the task, if any.

PSFs	PSF Levels	Multiplier for Action	If non-nominal PSF levels are selected, please note specific reasons in this column
Available Time	Inadequate time	P(failure) = 1.0 ☐	
	Time available time required	10 ☐	
	Nominal time	1 ☐	
	Time available>50 x time required	0.01 ☒	
Stress	Extreme	5 ☐	
	High	2 ☒	
	Nominal	1 ☐	
Complexity	Highly complex	5 ☒	Requires multiple steps
	Moderately complex	2 ☐	
	Nominal	1 ☐	
Experience/Training	Low	3 ☒	No training
	Nominal	1 ☐	
	High	0.5 ☐	
Procedures	Not available	50 ☒	No procedures
	Available, but poor	5 ☐	
	Nominal	1 ☐	
Ergonomics	Missing/Misleading	50 ☐	
	Poor	10 ☐	
	Nominal	1 ☒	
	Good	0.5 ☐	
Fitness for Duty	Unfit	P(failure) = 1.0 ☐	
	Degraded Fitness	5 ☐	
	Nominal	1 ☒	
Work Processes	Poor	5 ☐	
	Nominal	1 ☒	
	Good	0.5 ☐	

B. Calculate the Action Failure Probability

(1) If all PSF ratings are nominal, then the Action Failure Probability = 10E-3

(2) Otherwise,

	Time	Stress	Complexity	Experience/ Training	Procedures	Ergonomics	Fitness for Duty	Work Processes	
Action: 10E-3	x .01	x 2	x 5	x 3	x 50	x 1	x 1	x 1	= .15 Action Failure Probability

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Base case

SPAR HRA Human Error Worksheet (Page 1 of 3)

#1 85 hours

Plant:_____ **Initiating Event:**_____ **Sequence Number:**_____ **Basic Event Code:** HEP-INV-Offsite

Basic Event Context:_____

Basic Event Description:_____

Does this task contain a significant amount of diagnosis activity? YES ☐ (start with Part I, p. 1) NO ☐ (skip Part I, p. 1; start with Part II, p. 2) Why?_____

PART I. DIAGNOSIS

A. Evaluate PSFs for the diagnosis portion of the task.

PSFs	PSF Levels	Multiplier for Diagnosis	If non-nominal PSF levels are selected, please note specific reasons in this column
Available Time	Inadequate time	P(failure) = 1.0 ☐	Expansive time
	Barely adequate time 20 min	10 ☐	
	Nominal time 30 min	1 ☐	
	Extra time >60 min	0.1 ☐	
	Expansive time >24 hrs	0.01 ☒	
Stress	Extreme	5 ☐	Recognition of problems ongoing
	High	2 ☒	
	Nominal	1 ☐	
Complexity	Highly complex	5 ☐	Recognition of need to move to last opportunity
	Moderately complex	2 ☒	
	Nominal	1 ☐	
	Obvious diagnosis	0.1 ☐	
Experience/Training	Low	10 ☐	Highly trained staff
	Nominal	1 ☐	
	High	0.5 ☒	
Procedures	Not available	50 ☐	Procedures written, provides guidance for early entry into preparation
	Available, but poor	5 ☐	
	Nominal	1 ☐	
	Diagnostic/symptom oriented	0.5 ☒	
Ergonomics	Missing/Misleading	50 ☐	
	Poor	10 ☐	
	Nominal	1 ☒	
	Good	0.5 ☐	
Fitness for Duty	Unfit	P(failure) = 1.0 ☐	
	Degraded Fitness	5 ☐	
	Nominal	1 ☒	
Work Processes	Poor	2 ☐	
	Nominal	1 ☒	
	Good	0.8 ☐	

B. Calculate the Diagnosis Failure Probability

(1) If all PSF ratings are nominal, then the Diagnosis Failure Probability = 10E-2

(2) Otherwise,

	Time	Stress	Complexity	Experience/ Training	Procedures	Ergonomics	Fitness for Duty	Work Processes	
Diagnosis: 10E-2x	.01	x 2	x 2	x .5	x 5	x 1	x 1	x 1	= 1×10^{-4} Diagnosis Failure Probability

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SPAR HRA Human Error Worksheet (Page 2 of 3)

#1

Plant:_____ **Initiating Event:**_____ **Sequence Number:**_____ **Basic Event Code:** HEP-INV-Offsite

Basic Event Context: 128 hours

Basic Event Description:_____

Part II. ACTION

A. Evaluate PSFs for the action portion of the task, if any.

PSFs	PSF Levels	Multiplier for Action	If non-nominal PSF levels are selected, please note specific reasons in this column
Available Time	Inadequate time	P(failure) = 1.0 ☐	Expensive time
	Time available time required	10 ☐	
	Nominal time	1 ☐	
	Time available>50 x time required	0.01 ☒	
Stress	Extreme	5 ☒	Lost opportunity for success, stress is extreme
	High	2 ☐	
	Nominal	1 ☐	
Complexity	Highly complex	5 ☒	Involves offsite personnel + special means
	Moderately complex	2 ☐	
	Nominal	1 ☐	
Experience/Training	Low	3 ☐	Highly trained staff
	Nominal	1 ☐	
	High	0.5 ☒	
Procedures	Not available	50 ☐	Procedures written provides for early preparation, guidance
	Available, but poor	5 ☐	
	Nominal	1 ☒	
Ergonomics	Missing/Misleading	50 ☐	Equipment available to make offsite support straightforward (hoses, access, etc)
	Poor	10 ☐	
	Nominal	1 ☐	
	Good	0.5 ☒	
Fitness for Duty	Unfit	P(failure) = 1.0 ☐	
	Degraded Fitness	5 ☐	
	Nominal	1 ☒	
Work Processes	Poor	5 ☐	Crew and procedures that interact well in a good facility
	Nominal	1 ☐	
	Good	0.5 ☒	

B. Calculate the Action Failure Probability

(1) If all PSF ratings are nominal, then the Action Failure Probability = 10E-3

(2) Otherwise,	Time	Stress	Complexity	Experience/ Training	Procedures	Ergonomics	Fitness for Duty	Work Processes	
Action: 10E-3	x .01	x 5	x 5	x .5	x 1	x 5	x 1	x 5	= 3×10^{-5} Action Failure Probability

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SPAR HRA Human Error Worksheet (Page 3 of 3)

#1 HEP-INV-Offsite

Plant:_____ **Initiating Event:**_____ **Sequence Number:**_____ **Basic Event Code:**_____

PART III. CALCULATE THE TASK FAILURE PROBABILITY WITHOUT FORMAL DEPENDENCE ($P_{W/OD}$)

Calculate the Task Failure Probability Without Formal Dependence ($P_{w/od}$) by adding the Diagnosis Failure Probability (from Part I, p.1) and the Action Failure Probability (from Part II, p. 2).

Diagnosis Failure Probability:	1×10^{-4}	Diagnosis Failure Probability:	10E-2
Action Failure Probability:	+ 3×10^{-5}	Action Failure Probability:	+10E-3
Task Failure Without Formal Dependence ($P_{w/od}$)	= 1.3×10^{-4}	$P_{(w/od)}$= 1.1x10E-2	

If all PSFs are nominal, then

modified for low dependency .05

Part IV. DEPENDENCY

For all tasks, except the first task in the sequence, use the table and formulae below to calculate the Task Failure Probability With Formal Dependence (P_{wd}).

If there is a reason why failure on previous tasks should not be considered, explain here:

Dependency Condition Table

Crew (same or different)	Time (close in time or not close in time	Location (same or different)	Cues (additional or not additional)	Dependency	Number of Human Action Failures Rule ☐ - Not Applicable. Why?_____
Same	Close	Same		complete	If this error is the 3rd error in the sequence, then the dependency is at least moderate.
		Different		high	
	Not Close	Same	No Additional	high	If this error is the 4th error in the sequence, then the dependency is at least high.
			Additional	moderate	
		Different	No Additional	moderate	
			Additional	low	
Different	Close			moderate	This rule may be ignored only if there is compelling evidence for less dependence with the previous tasks. Explain above.
	Not Close			low	

Using $P_{w/od}$ = Probability of Task Failure Without Formal Dependence (calculated in Part III, p. 3):

For Complete Dependence the probability of failure is 1.

For High Dependence the probability of failure is $(1+P_{w/od})/2$

For Moderate Dependence the probability of failure is $(1+6 \times P_{w/od})/7$

For Low Dependence the probability of failure is $(1+19 \times P_{w/od})/20$

For Zero Dependence the probability of failure is $P_{w/od}$

Calculate $P_{w/d}$ using the appropriate values:

$(1 + (19 * 1.3E^{-4}))/$ = .05 Task Failure Probability With Formal Dependence (P_{wd})

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Sensitivity case #2 85 hours

SPAR HRA Human Error Worksheet (Page 1 of 3)

Plant:_____ **Initiating Event:**_____ **Sequence Number:**_____ **Basic Event Code:** HEP-INV-Offsite

Basic Event Context:_____

Basic Event Description:_____

Does this task contain a significant amount of diagnosis activity? YES ☐ (start with Part I, p. 1) NO ☐ (skip Part I, p. 1; start with Part II, p. 2) Why?_____

PART I. DIAGNOSIS

A. Evaluate PSFs for the diagnosis portion of the task.

PSFs	PSF Levels	Multiplier for Diagnosis	If non-nominal PSF levels are selected, please note specific reasons in this column
Available Time	Inadequate time	P(failure) = 1.0 ☐	
	Barely adequate time 20 min	10 ☐	Expensive time
	Nominal time 30 min	1 ☐	
	Extra time >60 min	0.1 ☐	
	Expansive time >24 hrs	0.01 ☒	
Stress	Extreme	5 ☐	Recognition of problems ongoing
	High	2 ☒	
	Nominal	1 ☐	
Complexity	Highly complex	5 ☐	Recognition of need to move to last opportunity
	Moderately complex	2 ☒	
	Nominal	1 ☐	
	Obvious diagnosis	0.1 ☐	
Experience/Training	Low	10 ☒	No training
	Nominal	1 ☐	
	High	0.5 ☐	
Procedures	Not available	50 ☒	No procedures
	Available, but poor	5 ☐	
	Nominal	1 ☐	
	Diagnostic/symptom oriented	0.5 ☐	
Ergonomics	Missing/Misleading	50 ☐	
	Poor	10 ☐	
	Nominal	1 ☒	
	Good	0.5 ☐	
Fitness for Duty	Unfit	P(failure) = 1.0 ☐	
	Degraded Fitness	5 ☐	
	Nominal	1 ☒	
Work Processes	Poor	2 ☐	
	Nominal	1 ☒	
	Good	0.8 ☐	

B. Calculate the Diagnosis Failure Probability

(1) If all PSF ratings are nominal, then the Diagnosis Failure Probability = 10E-2

(2) Otherwise,

	Time	Stress	Complexity	Experience/ Training	Procedures	Ergonomics	Fitness for Duty	Work Processes	
Diagnosis: 10E-2x	.01	x 2	x 2	x 10	x 50	x 1	x 1	x 1	= .2 Diagnosis Failure Probability

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SPAR HRA Human Error Worksheet (Page 2 of 3)

Plant:_____ Initiating Event:_____ Sequence Number:_____ Basic Event Code: HEP-INV-OFFSITE #2

Basic Event Context:_____

Basic Event Description:_____

Part II. ACTION

A. Evaluate PSFs for the action portion of the task, if any.

PSFs	PSF Levels	Multiplier for Action	If non-nominal PSF levels are selected, please note specific reasons in this column
Available Time	Inadequate time	P(failure) = 1.0 ☐	Expensive time
	Time available time required	10 ☐	
	Nominal time	1 ☐	
	Time available>50 x time required	0.01 ☒	
Stress	Extreme	5 ☒	Last opportunity for success, stress extreme
	High	2 ☐	
	Nominal	1 ☐	
Complexity	Highly complex	5 ☒	Involving offsite personnel and special means
	Moderately complex	2 ☐	
	Nominal	1 ☐	
Experience/Training	Low	3 ☒	no training
	Nominal	1 ☐	
	High	0.5 ☐	
Procedures	Not available	50 ☒	no procedures
	Available, but poor	5 ☐	
	Nominal	1 ☐	
Ergonomics	Missing/Misleading	50 ☐	
	Poor	10 ☐	
	Nominal	1 ☒	
	Good	0.5 ☐	
Fitness for Duty	Unfit	P(failure) = 1.0 ☐	
	Degraded Fitness	5 ☐	
	Nominal	1 ☒	
Work Processes	Poor	5 ☐	
	Nominal	1 ☒	
	Good	0.5 ☐	

B. Calculate the Action Failure Probability

(1) If all PSF ratings are nominal, then the Action Failure Probability = 10E-3

(2) Otherwise,

	Time	Stress	Complexity	Experience/ Training	Procedures	Ergonomics	Fitness for Duty	Work Processes	
Action: 10E-3	x .01	x 5	x 5	x 3	x 50	x 1	x 1	x 1	= 3.75×10^{-2} Action Failure Probability

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 #2 HEP- INV-DIAGS-I

Plant:_____ Initiating Event:_____ Sequence Number:_____ Basic Event Code:_____

PART III. CALCULATE THE TASK FAILURE PROBABILITY WITHOUT FORMAL DEPENDENCE ($P_{W/OD}$)

Calculate the Task Failure Probability Without Formal Dependence ($P_{w/od}$) by adding the Diagnosis Failure Probability (from Part I, p.1) and the Action Failure Probability (from Part II, p. 2).

Diagnosis Failure Probability: .2 (modified for low dependency on prior diagnosis)

Action Failure Probability: + .0375

Task Failure Without Formal Dependence ($P_{w/od}$) = .23

modified for low dependency = .32

If all PSFs are nominal, then

Diagnosis Failure Probability: 10E-2

Action Failure Probability: +10E-3

$P_{(w/od)}$= 1.1x10E-2

Part IV. DEPENDENCY

For all tasks, except the first task in the sequence, use the table and formulae below to calculate the Task Failure Probability With Formal Dependence (P_{wd}).

If there is a reason why failure on previous tasks should not be considered, explain here:

Dependency Condition Table

Crew (same or different)	Time (close in time or not close in time	Location (same or different)	Cues (additional or not additional)	Dependency	Number of Human Action Failures Rule ☐ - Not Applicable. Why?_____
Same	Close	Same		complete	If this error is the 3rd error in the sequence, then the dependency is at least moderate.
		Different		high	
	Not Close	Same	No Additional	high	
			Additional	moderate	If this error is the 4th error in the sequence, then the dependency is at least high.
		Different	No Additional	moderate	
			Additional	low	
Different	Close			moderate	This rule may be ignored only if there is compelling evidence for less dependence with the previous tasks. Explain above.
	Not Close			(low)	

Using $P_{w/od}$ = Probability of Task Failure Without Formal Dependence (calculated in Part III, p. 3):

For Complete Dependence the probability of failure is 1.

For High Dependence the probability of failure is $(1+P_{w/od})/2$

For Moderate Dependence the probability of failure is $(1+6 \times P_{w/od})/7$

For Low Dependence the probability of failure is $(1+19 \times P_{w/od})/20$

For Zero Dependence the probability of failure is $P_{w/od}$

Calculate $P_{w/d}$ using the appropriate values:

(1 + (19 * .23))/ = .32 Task Failure Probability With Formal Dependence (P_{wd})

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