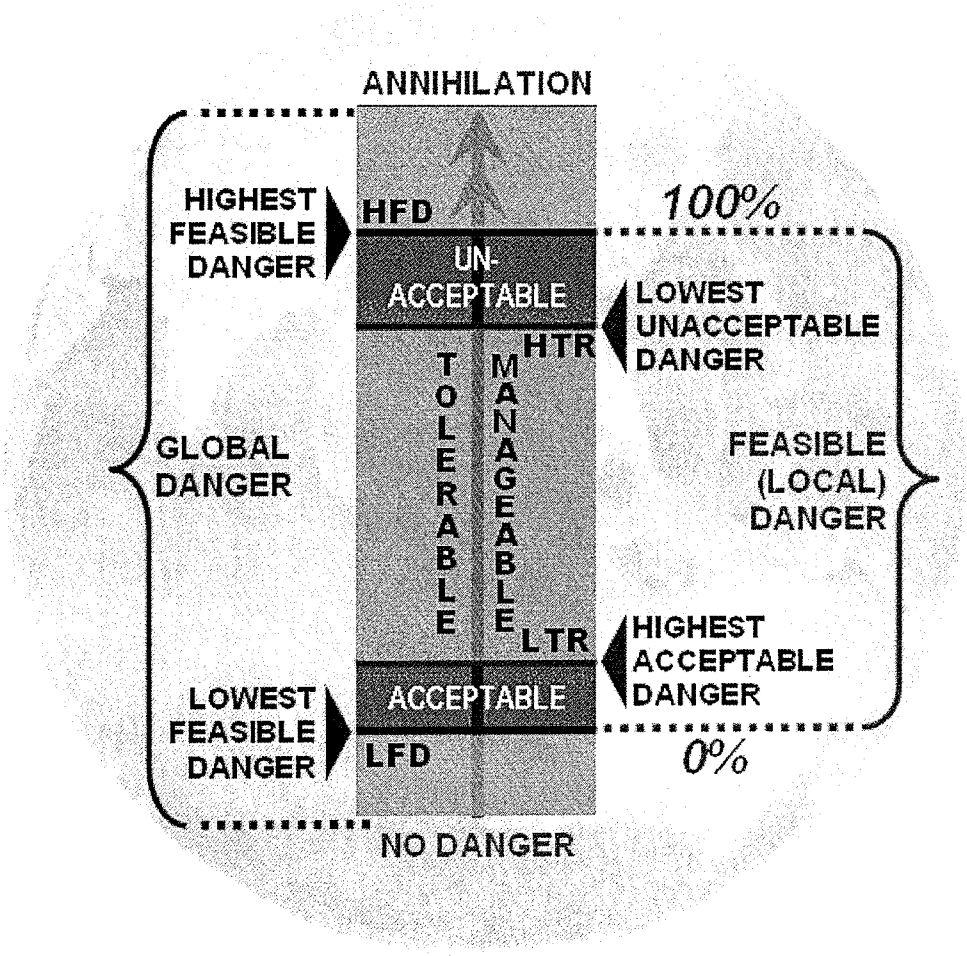

ANNIHILATION
HIGHEST FEASIBLE DANGER
HFD
100%
UN-ACCEPTABLE
LOWEST UNACCEPTABLE DANGER
HTR
TOLERABLE
MANAGEABLE
GLOBAL DANGER
FEASIBLE (LOCAL) DANGER
LTR
HIGHEST ACCEPTABLE DANGER
LOWEST FEASIBLE DANGER
ACCEPTABLE
LFD
0%
NO DANGER

Fig. 1

Severity	Likelihood		
	Low	Medium	High
High	Medium	High	High
Medium	Low	Medium	High
Low	Low	Low	Medium

Fig. 2

Severity	Likelihood		
	(Low) 1	(Medium) 2	(High) 3
(High) 3	3	6	9
(Medium) 2	2	4	6
(Low) 1	1	2	3

Risk Category	Risk Index Ranges	Risk Designation
I	1-2	Low
II	3-4	Medium
III	6-9	High

Fig. 3

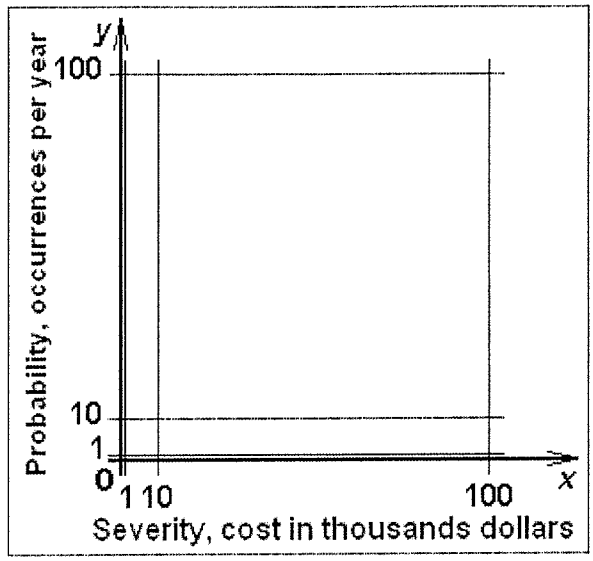

y
100
10
1
0
1 10
100
x
Probability, occurrences per year
Severity, cost in thousands dollars

Fig. 4

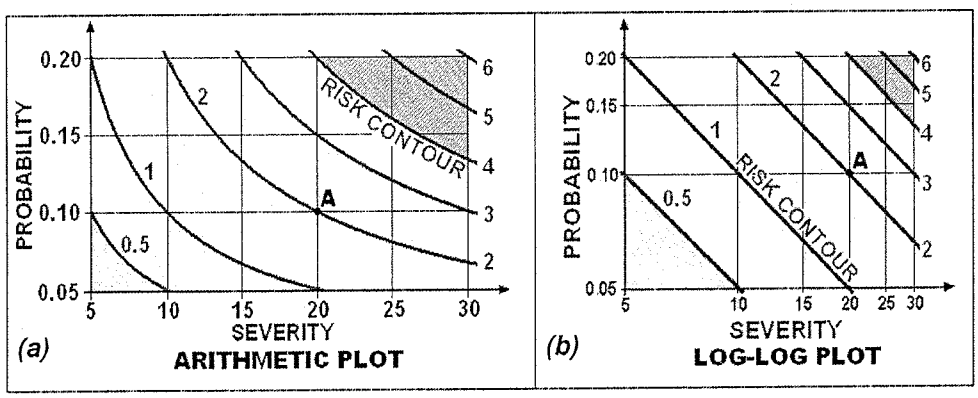

PROBABILITY
0.20
0.15
0.10
0.05
5
10
15
20
25
30
SEVERITY
RISK CONTOUR
1
2
0.5
A
6
5
4
3
2
(a)
ARITHMETIC PLOT
(b)
LOG-LOG PLOT

Fig. 5

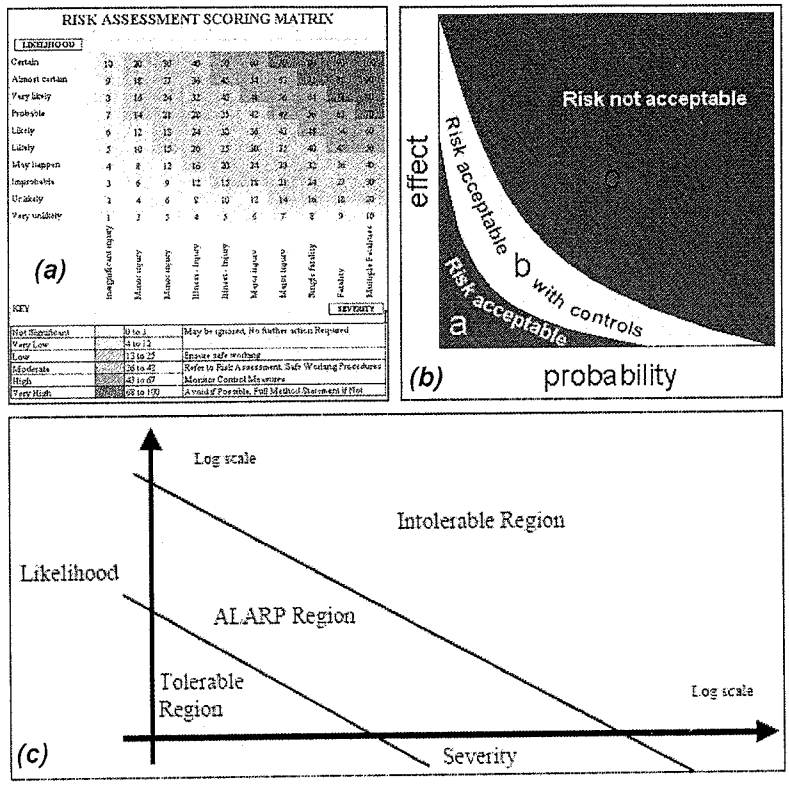
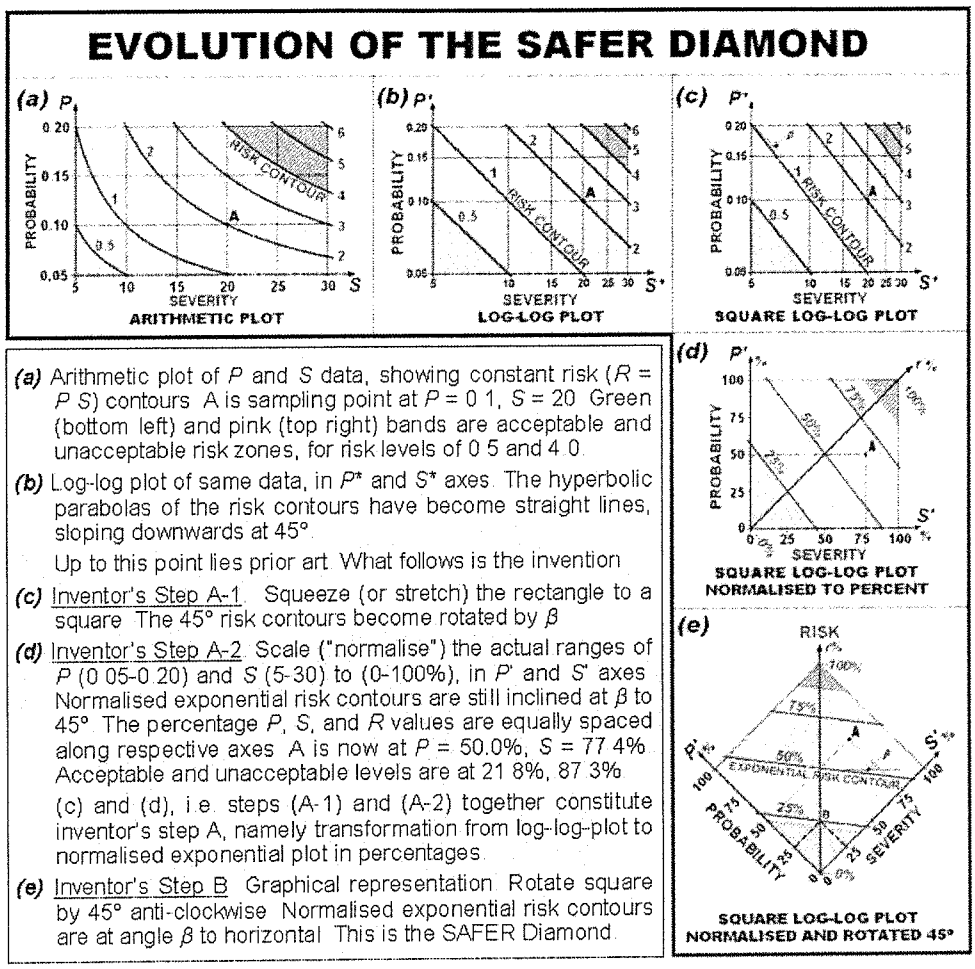

RISK ASSESSMENT SCORING MATRIX
LIKELIHOOD
Certain
Almost certain
Very likely
Probable
Likely
Likely
May happen
Improbable
Unlikely
Very unlikely
(a)
KEY
SEVERITY
Not Significant
Very Low
Low
Moderate
High
Very High
0 to 4
5 to 12
13 to 25
26 to 42
43 to 67
68 to 100
May be ignored, No further action Required
Refer to Risk Assessment, Safe Working Procedures
Monitor Control Measures
Risk not acceptable
Risk acceptable
with controls
Risk acceptable
effect
probability
(b)
Log scale
Intolerable Region
Likelihood
ALARP Region
Tolerable
Region
Log scale
Severity
(c)

Fig. 6



(a) Arithmetic plot of P and S data, showing constant risk ($R = P\,S$) contours. A is sampling point at $P = 0.1$, $S = 20$. Green (bottom left) and pink (top right) bands are acceptable and unacceptable risk zones, for risk levels of 0.5 and 4.0.

(b) Log-log plot of same data, in P^* and S^* axes. The hyperbolic parabolas of the risk contours have become straight lines, sloping downwards at 45°.

Up to this point lies prior art. What follows is the invention.

(c) Inventor's Step A-1. Squeeze (or stretch) the rectangle to a square. The 45° risk contours become rotated by β.

(d) Inventor's Step A-2. Scale ("normalise") the actual ranges of P (0.05-0.20) and S (5-30) to (0-100%), in P' and S' axes. Normalised exponential risk contours are still inclined at β to 45°. The percentage P, S, and R values are equally spaced along respective axes. A is now at $P = 50.0\%$, $S = 77.4\%$. Acceptable and unacceptable levels are at 21.8%, 87.3%.

(c) and (d), i.e. steps (A-1) and (A-2) together constitute inventor's step A, namely transformation from log-log-plot to normalised exponential plot in percentages.

(e) Inventor's Step B. Graphical representation. Rotate square by 45° anti-clockwise. Normalised exponential risk contours are at angle β to horizontal. This is the SAFER Diamond.

Fig. 7

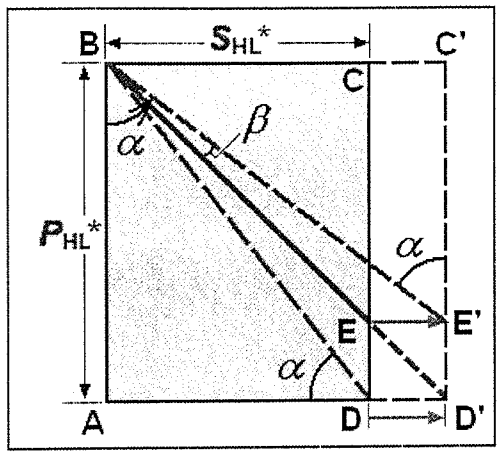

B
S_{HL}*
C'
C
β
α
P_{HL}*
α
E
E'
α
A
D
D'

Fig. 8

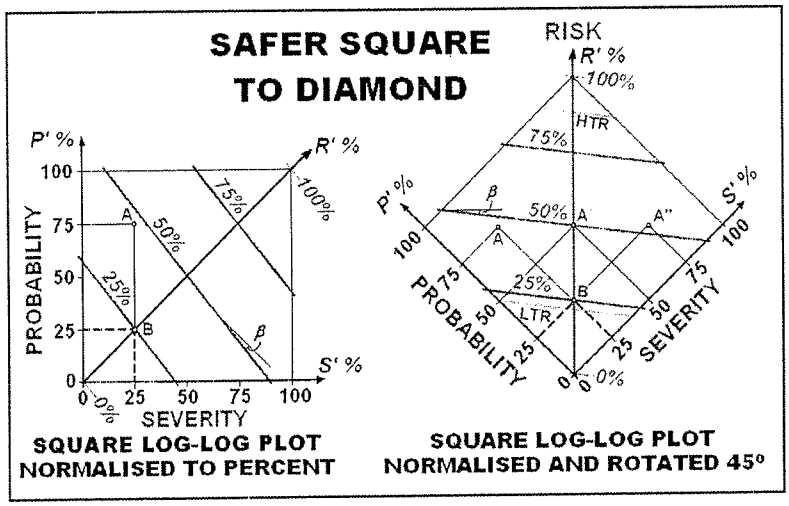

SAFER SQUARE
TO DIAMOND
P' %
R' %
100
75
50
25
0
PROBABILITY
A
B
75%
100%
50%
25%
β
S' %
0 0% 25 50 75 100
SEVERITY
SQUARE LOG-LOG PLOT
NORMALISED TO PERCENT
RISK
R' %
100%
HTR
75%
P' %
β
50%
A
A''
S' %
100
A'
25%
B
LTR
75
50
25
0 0%
PROBABILITY
SEVERITY
SQUARE LOG-LOG PLOT
NORMALISED AND ROTATED 45°

Fig. 9

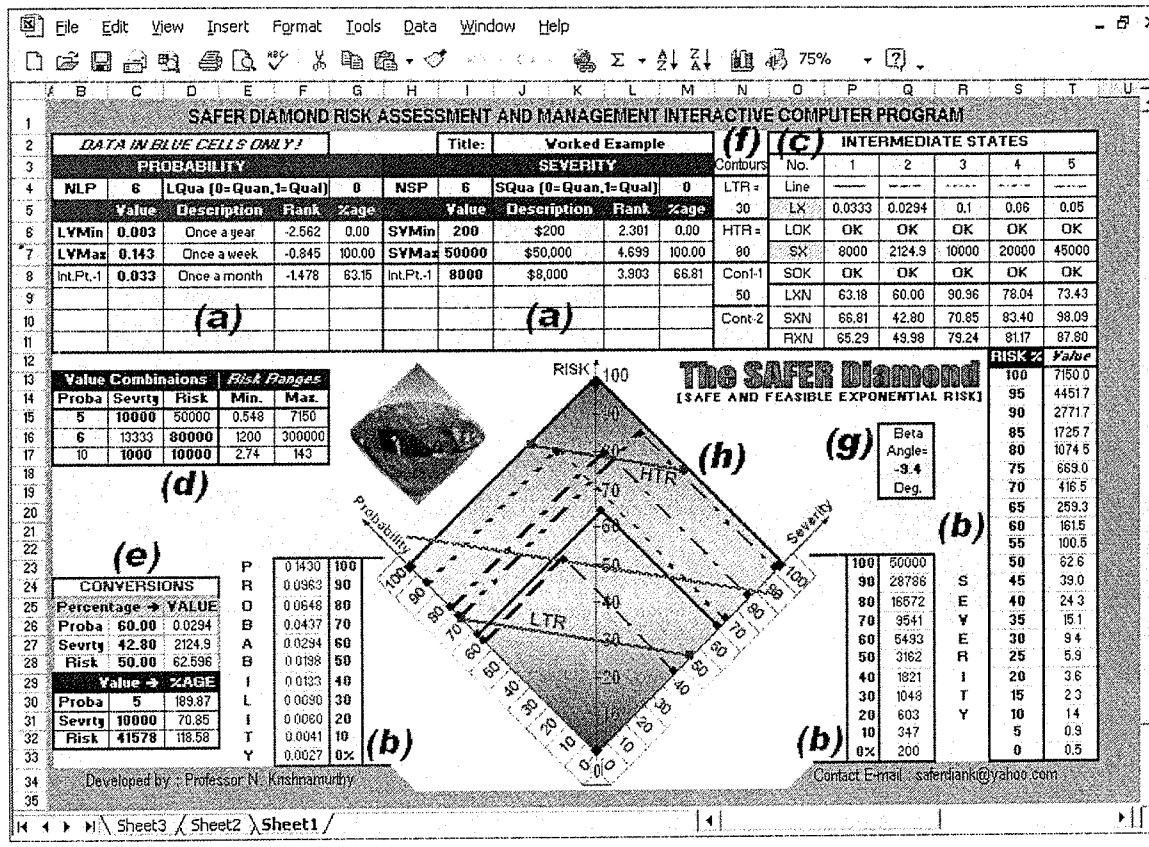

File Edit View Insert Format Tools Data Window Help
SAFER DIAMOND RISK ASSESSMENT AND MANAGEMENT INTERACTIVE COMPUTER PROGRAM
DATA IN BLUE CELLS ONLY !
Title: Worked Example
PROBABILITY
SEVERITY
NLP 6 LQua (0=Quan,1=Qual) 0 NSP 6 SQua (0=Quan,1=Qual) 0
LVMin 0.003 Once a year -2.562 0.00 SVMin 200 $200 2.301 0.00
LVMax 0.143 Once a week -0.845 100.00 SVMax 50000 $50,000 4.699 100.00
Int.Pt.-1 0.033 Once a month -1.478 63.15 Int.Pt.-1 8000 $8,000 3.903 66.81
(a)
(a)
(f)
(c)
INTERMEDIATE STATES
LTR = 30
HTR = 80
Cont-1 50
Cont-2
LX 0.0333 0.0294 0.1 0.06 0.05
LOK OK OK OK OK OK
SX 8000 2124.9 10000 20000 45000
SOK OK OK OK OK OK
LXN 63.18 60.00 90.96 78.04 73.43
SXN 66.81 42.80 70.85 83.40 98.09
RXN 65.29 49.98 79.24 81.17 87.80
Value Combinaions | Risk Ranges
Proba Sevrty Risk Min. Max.
5 10000 50000 0.548 7150
6 13333 80000 1200 300000
10 1000 10000 2.74 143
(d)
RISK
HTR
LTR
Probability
Severity
(h)
(g)
Beta Angle= -9.4 Deg.
The SAFER Diamond
[SAFE AND FEASIBLE EXPONENTIAL RISK]
(b)
(b)
(b)
(e)
CONVERSIONS
Percentage → VALUE
Proba 60.00 0.0294
Sevrty 42.80 2124.9
Risk 50.00 62.596
Value → %AGE
Proba 5 189.87
Sevrty 10000 70.85
Risk 41578 118.58
P R O B A I L I T Y
S E V E R I T Y
RISK %
Developed by : Professor N. Krishnamurthy
Contact E-mail : saferdiamk@yahoo.com
Sheet3 Sheet2 Sheet1

Fig. 10