SAFETY CULTURE

Some observations …

Pipeline & Hazardous Materials Safety Administration

April 17, 2008

#1

People often interpret new information to reinforce existing beliefs.

Coast Guard Cutter *Cuyahoga*


TARGET 0300-200064124 U


157

The recommendation to launch …

MTI ASSESSMENT OF TEMPERATURE CONCERN ON SRM-25 (51L) LAUNCH

- CALCULATIONS SHOW THAT SRM-25 O-RINGS WILL BE 20° COLDER THAN SRM-15 O-RINGS
- TEMPERATURE DATA NOT CONCLUSIVE ON PREDICTING PRIMARY O-RING BLOW-BY
- ENGINEERING ASSESSMENT IS THAT:
  - COLDER O-RINGS WILL HAVE INCREASED EFFECTIVE DUROMETER ("HARDER")
  - "HARDER" O-RINGS WILL TAKE LONGER TO "SEAT"
    - MORE GAS MAY PASS PRIMARY O-RING BEFORE THE PRIMARY SEAL SEATS (RELATIVE TO SRM-15)
      - DEMONSTRATED SEALING THRESHOLD IS 3 TIMES GREATER THAN 0.038" EROSION EXPERIENCED ON SRM-15
  - IF THE PRIMARY SEAL DOES NOT SEAT, THE SECONDARY SEAL WILL SEAT
    - PRESSURE WILL GET TO SECONDARY SEAL BEFORE THE METAL PARTS ROTATE
      - O-RING PRESSURE LEAK CHECK PLACES SECONDARY SEAL IN OUTBOARD POSITION WHICH MINIMIZES SEALING TIME

- MTI RECOMMENDS STS-51L LAUNCH PROCEED ON 28 JANUARY 1986
  - SRM-25 WILL NOT BE SIGNIFICANTLY DIFFERENT FROM SRM-15

JOE C. KILMINSTER, VICE PRESIDENT
SPACE BOOSTER PROGRAMS

MORTON THIOKOL INC.
Wasatch Division

INFORMATION ON THIS PAGE WAS PREPARED TO SUPPORT AN ORAL PRESENTATION AND CANNOT BE CONSIDERED COMPLETE WITHOUT THE ORAL DISCUSSION

#2

It’s almost never

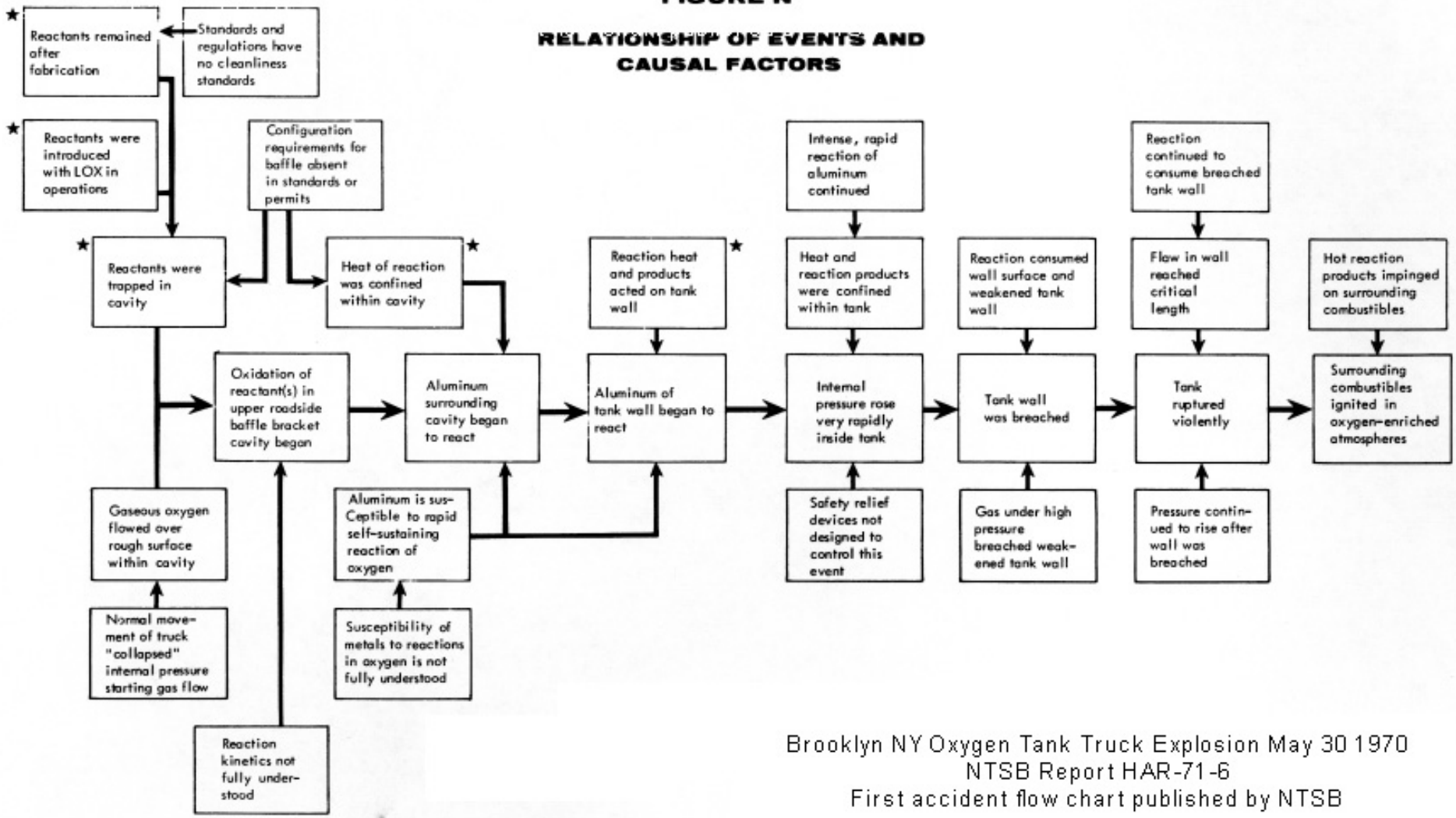
just one failure.


tex

One primary cause;
18 weaknesses and other risk factors
that might have contributed to the accident.

FIGURE N

RELATIONSHIP OF EVENTS AND CAUSAL FACTORS



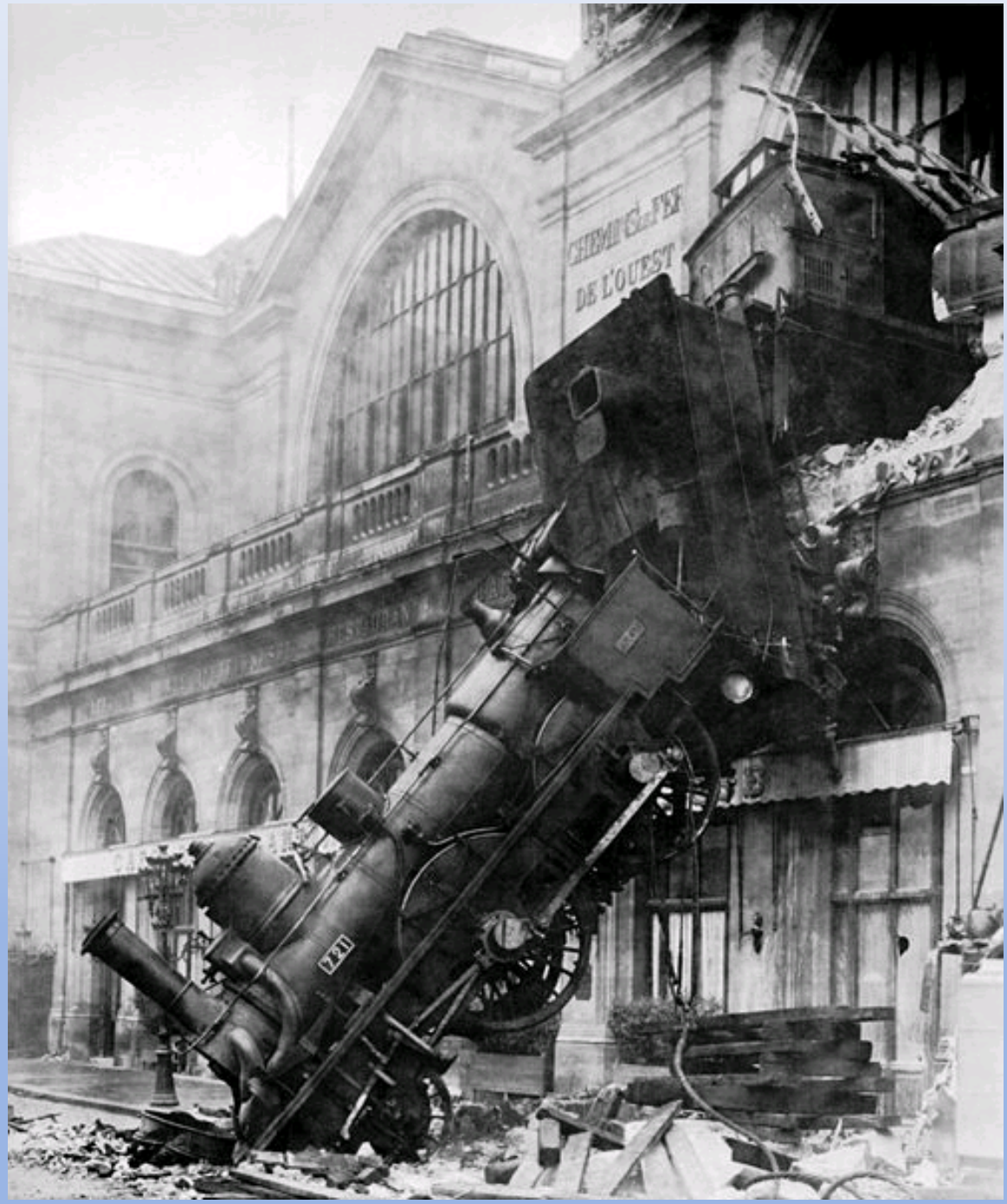
★ SEE SectionIII, c., PROBABLE SEQUENCE OF EVENTS

Brooklyn NY Oxygen Tank Truck Explosion May 30 1970
NTSB Report HAR-71-6
First accident flow chart published by NTSB

#3

There is almost always
a human error
somewhere in
the accident chain.

Train wreck at Montparnasse, France (1895)



General Human-Error Probabilities

in Various Operating Conditions (Kirwan 1994)

Description	Error Probability
General rate for errors involving high stress levels	0.3
Operator fails to act correctly in the first 30 minutes of an emergency situation	0.1
Operator fails to act correctly after the first few hours in a high stress situation	0.03
Error in a routine operation where care is required	0.01
Error in simple routine operation	0.001
Selection of the wrong switch (dissimilar in shape)	0.001
Human-performance limit: single operator	0.0001
Human-performance limit: team of operators performing a well designed task	0.00001

#4

People provide
an important safeguard
in the system.

A New (Systems) Approach

How It Is Now . . .	***How It Might Be . . .***
You are highly trained	**You are human**
and	*and*
If you did as trained, you would not make mistakes	**Humans make mistakes**
so	*so*
You weren't careful enough	**Let's also explore why the system allowed, or failed to accommodate, your mistake**
so	*and*
You should be PUNISHED!	**Let's IMPROVE THE SYSTEM!**

#5

How people act depends on the culture of the organization.

"I believe a culture exists at this refinery that encourages raising safety process concerns."

Percent that ***Disagree*** or ***Tend to Disagree***

Category	Carson	Cherry Point	Texas City	Toledo	Whiting
Operators	8	1	23	30	9
Maintenance/Craft Technicians	15	2	23	38‡	9
Full-Time HSSE Employees	3	4	29	16‡	13
Engineering Professionals	5	4	17	15	8
Operations Management	0	5	7	7	5
Maintenance Management	0‡	0‡	16	*	0
Contractors	8	7	12	8	10

* Survey data are not available because of the small number (fewer than 15) of potential respondents.
‡ Fewer than 25 respondents were in this group.

The Report of the BP U.S. Refineries Independent Safety Review Panel

#6

Safety culture =

a learning culture.

A safety culture = a learning culture

Some elements …	Some conditions …
Monitoring	*Communications*
Reporting near-misses	*Trust*
Leading indicators	*Empowerment*
Root cause analysis	*Sharing lessons learned*

#7

Risk is often misunderstood …

partly because

it is often misrepresented.

Space Shuttle O-ring data …

Blow By History

SRM-15 worst Blow-By

- 2 case joints (80°), (110°) Arc
- Much worse visually than SRM-22

SRM 22 Blow-By

- 2 case joints (30-40°)

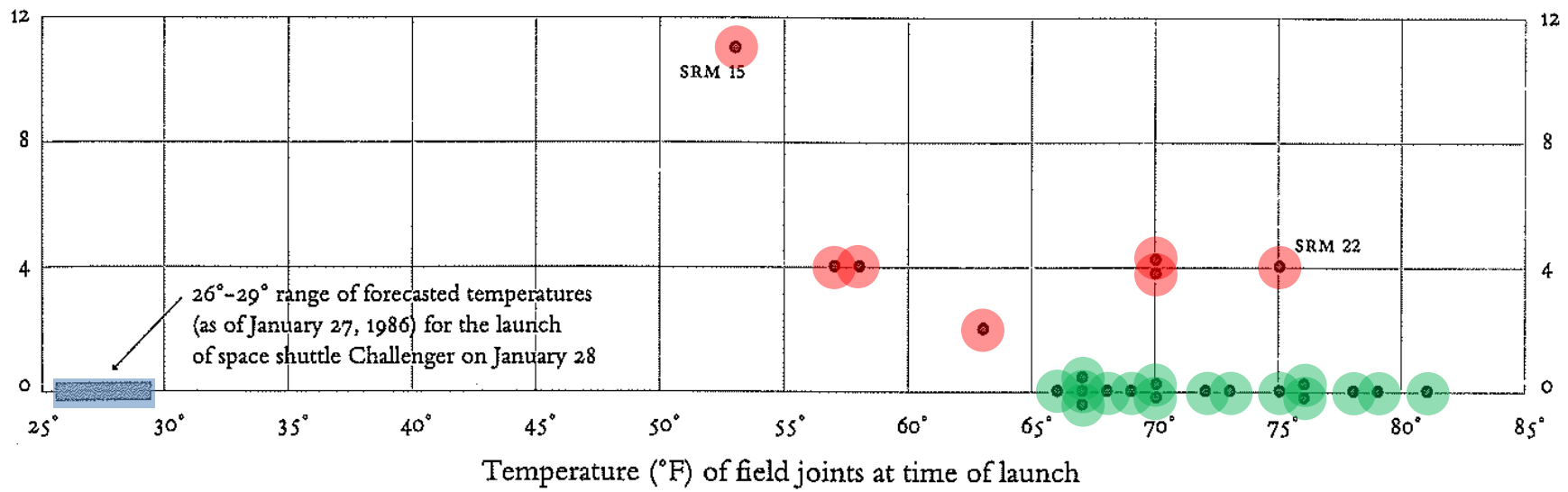
SRM-13A, 15, 16A, 18, 23A 24A

- Nozzle Blow-By

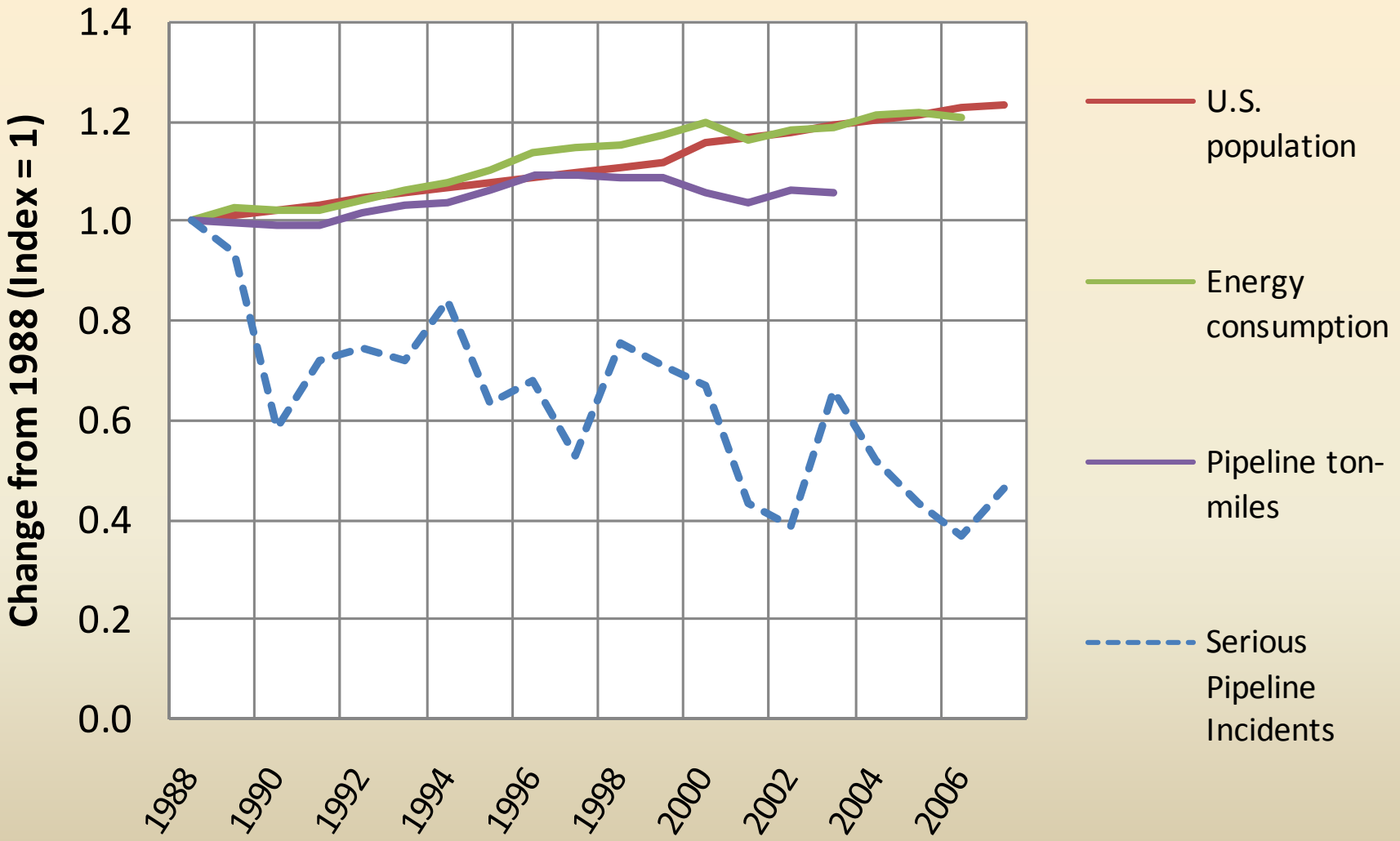
History of O-ring Temperatures (degrees-F)

Motor	MBT	Amb	O-ring	Wind
DM-4	68	36	47	10 mph
DM-2	76	45	52	10 mph
QM-3	72.5	40	48	10 mph
QM-4	76	48	51	10 mph
SRM-15	52	64	53	10 mph
SRM-22	77	78	75	10 mph
SRM-25	55	26	29 27	10 mph 25 mph

Re-assembly of the data by Edward Tufte

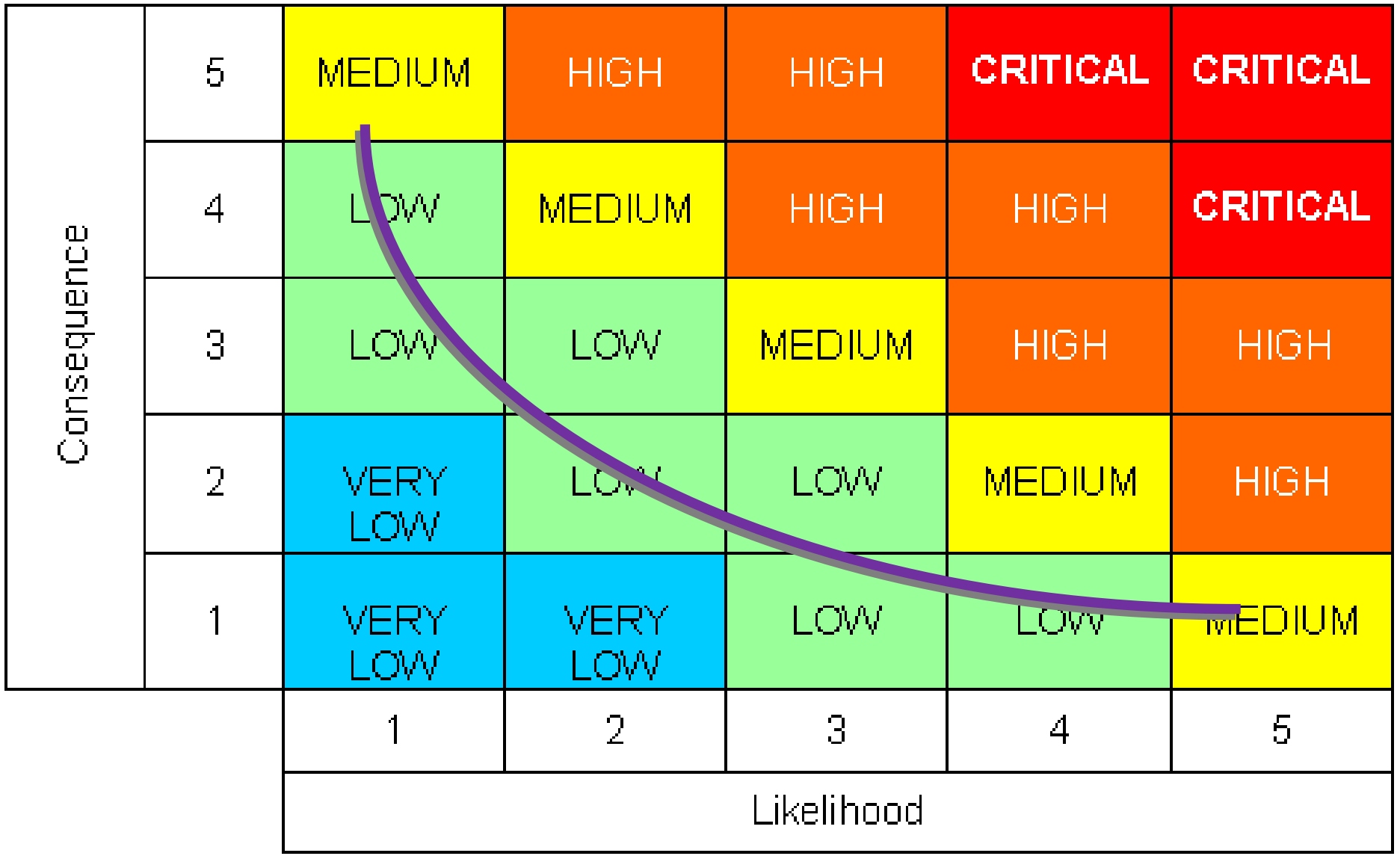


Pipeline Safety: Context Measures



Source: DOT/PHMSA Incident Data, as of Dec. 21, 2007

Risk = *f* (Likelihood, Consequences)



Some questions to consider …

1. *How can we learn more from events?*
2. *How do leaders affect operations—especially in dealing with errors?*
3. *What are the secrets to resiliency in an organization?*
4. *What makes an organization ready to adapt in a significantly challenging event?*
5. *How can we improve how we assemble and interpret information, including leading indicators?*