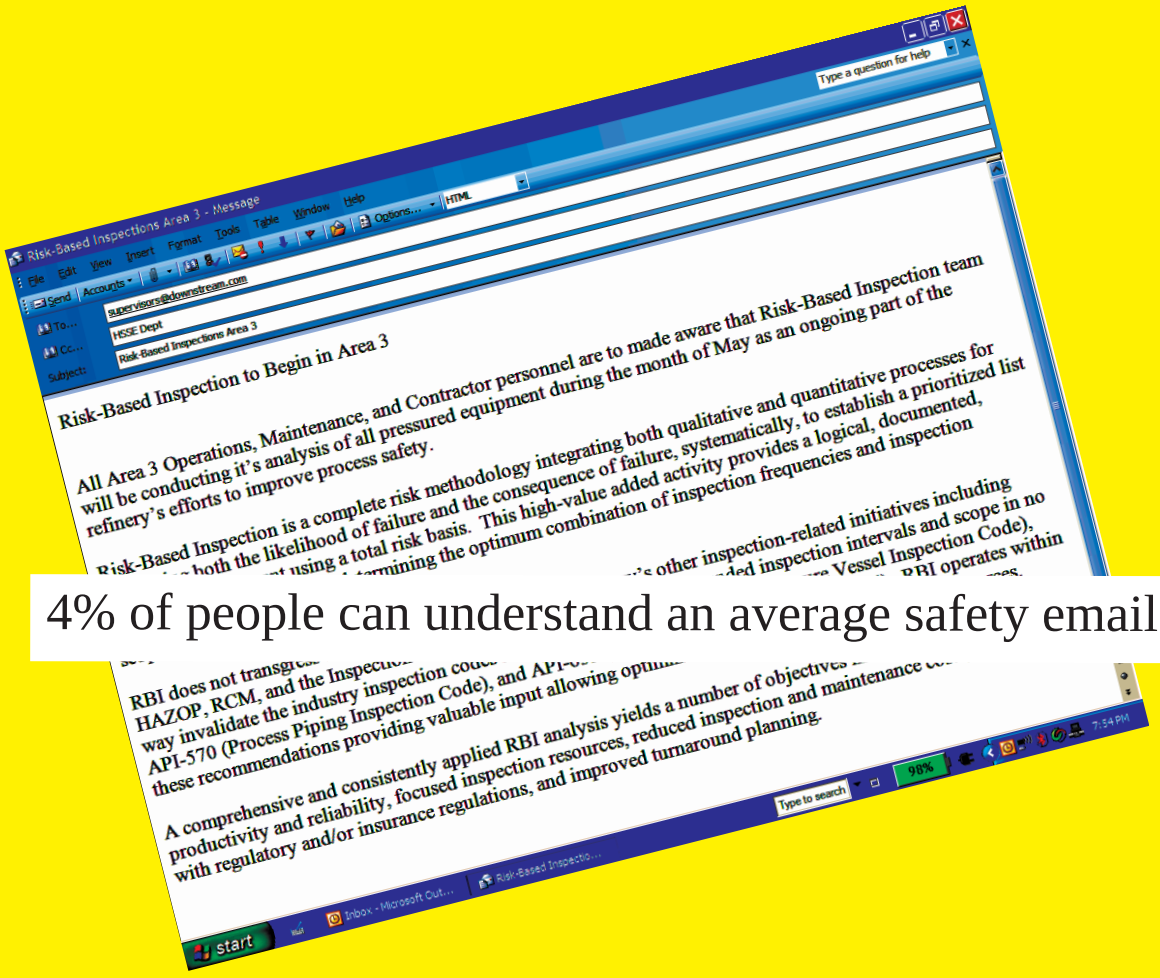
You Know Safety
But Admit It.....
You Don't Know Communication

Fixing Safety Communication in Oil Refineries

Dr TJ Larkin & Sandar Larkin



4% of people can understand an average safety email

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You Send Way Too Much

If employees read all the safety information you sent, refineries would look like this:

Apparently the theory is: send tons of stuff and something might stick.

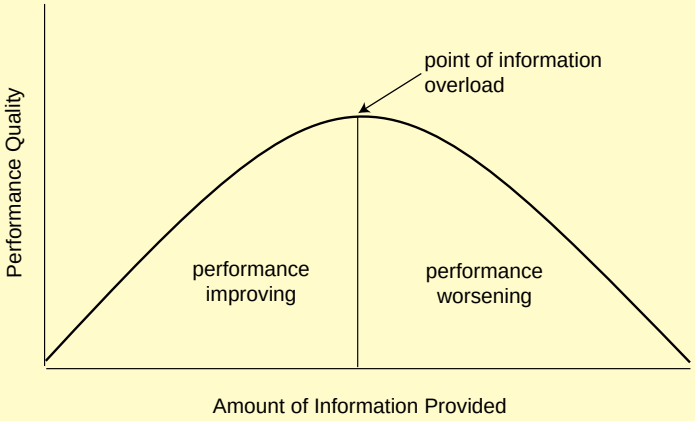
This is a bad theory.

More than 50 years of communication research shows:

> When people have no information, giving them some improves their performance.
>
> However, once people are saturated with information (information overload) the more information you give them, the less total information they use, and the worse their performance.

Source: O'Reilly

After Information Overload
Providing More Information Lowers Performance



Source: Chewning

After information overload, why does more information lower performance?

Before information overload, employees can concentrate exclusively on understanding.

After information overload, employees have more information than they can understand.

Now they must begin selecting which information to think about.

The more information you give them, the more time and energy they spend on selecting.

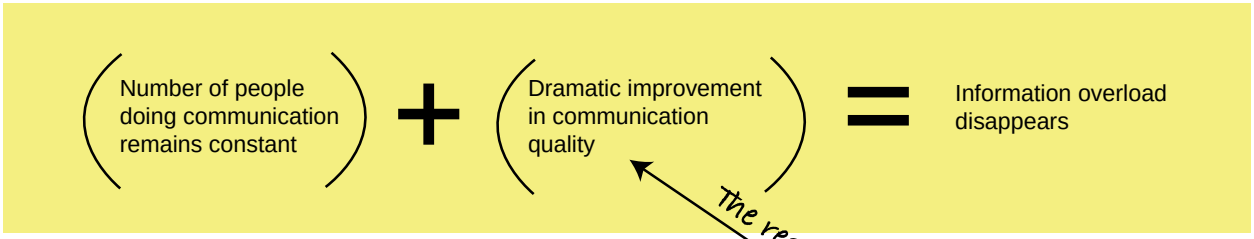
"Selecting" is stealing resources from "understanding" resulting in poorer performance.

Source: Iastrebova

Fixing Information Overload is Easy

The poor quality of your safety communication is what enables your information overload.

Fixing it is easy.



The rest of this report shows how to do this.

It takes more time and effort to do high-quality communication.

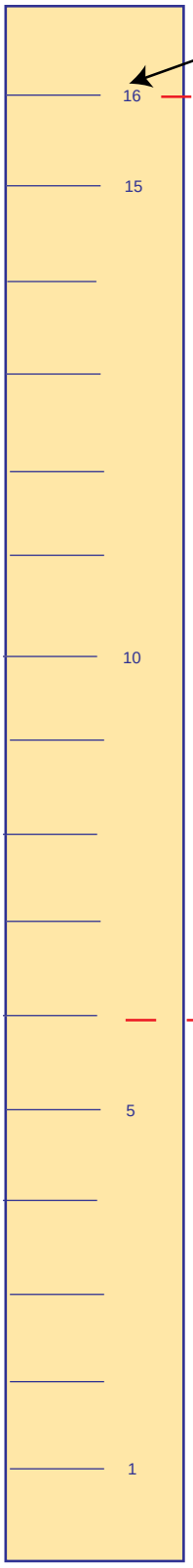
Once a commitment is made to communicate better, safety communicators will:

- choose their topics more carefully (moving "selection" from receivers to senders)
- spend considerably more time preparing each piece of communication
- and consequently, produce much less of it

If You End Information Overload
Refinery Supervisors and Frontline Employees Will:

Use more information	Non-overloaded employees use 25% more information than overloaded ones	source: Chewning
Remember more of it	High-quality communication improves recall by 75%	source: David
Perform better	High-quality communication improves problem-solving by 100%	source: Mayer

4% of People Can Understand An Average Safety Email



Safety communication in refineries is here*
16th grade level
4% of U.S. population can understand

15th grade level
MicroSoft Word Manual
7% can understand

Grade levels matter.
The correlation between the grade level of the text and its comprehension is large (r = 0.70)
Source: DuBay

Here is the gap you must close

10th grade level
New York Times
33% can understand

Average adult reading level (U.S.)
7th grade level**

7th grade level
Tom Clancy novels
50% can understand

5th grade level
TV Guide/Cosmopolitan
68% can understand

Technical communicators recommend:
5th to 7th grade level.
Optimizes percent who can understand; while maintaining enough linguistic complexity to communicate technical information.

3rd grade level
National Enquirer
80% can understand

* Sample:
3 oil refineries; 1 chemical refinery (4 separate companies)
8 frontline supervisors gave us 3 samples of safety communication randomly selected from their email inboxes
24 total pieces of safety communication studied
average grade level 15.5
Flesch-Kincaid readability formula
16th grade level
grade 16 = 12 years (elementary/high school) + 4 years (university)
4% of U.S. population can understand

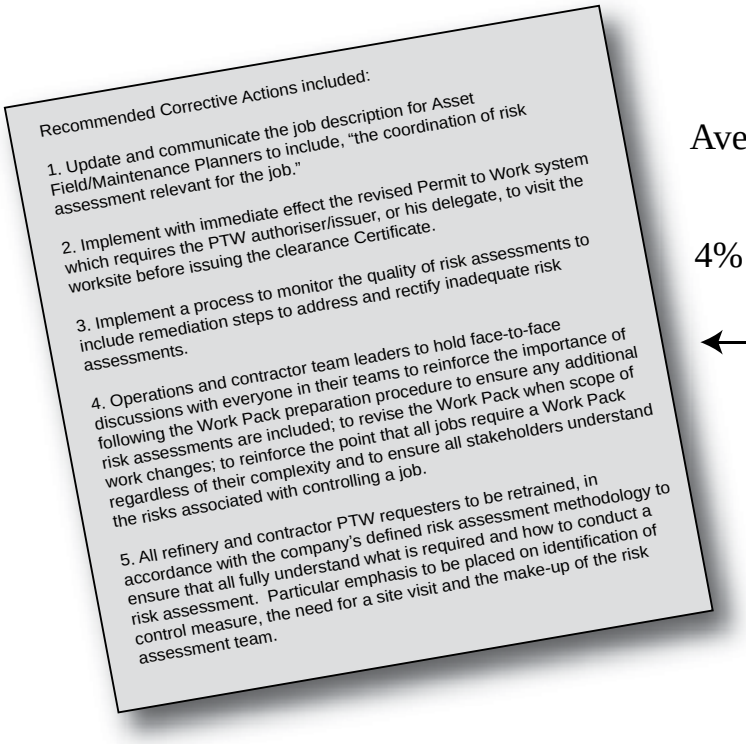
Sources: DuBay, Montondon

** U.S. adult average reading level is 7th grade.
For most adults, reading skills decline over time. So, on average, an adult's reading level is 5 grade levels lower than the last grade he/she actually completed. Adults with reading levels below 5th grade rarely use print to get information. Instead they rely on oral sources (TV/radio, family and friends).

Sources: Aldridge, Brownson

Grade 16 to Grade 5 (Example: Fin-Fan Accident)

Background: A contractor was taking down scaffolding located on top of a fin-fan cooler. The fan blades were covered by a fence-type cage mesh. Unfortunately this cage mesh was torn in places. The contractor accidently stepped on the torn mesh, his leg broke through and was cut by the rotating blades. Later, in hospital, his leg was amputated below the knee.



Recommended Corrective Actions included:

1. Update and communicate the job description for Asset Field/Maintenance Planners to include, "the coordination of risk assessment relevant for the job."

2. Implement with immediate effect the revised Permit to Work system which requires the PTW authoriser/issuer, or his delegate, to visit the worksite before issuing the clearance Certificate.

3. Implement a process to monitor the quality of risk assessments to include remediation steps to address and rectify inadequate risk assessments.

4. Operations and contractor team leaders to hold face-to-face discussions with everyone in their teams to reinforce the importance of following the Work Pack preparation procedure to ensure any additional risk assessments are included; to revise the Work Pack when scope of work changes; to reinforce the point that all jobs require a Work Pack regardless of their complexity and to ensure all stakeholders understand the risks associated with controlling a job.

5. All refinery and contractor PTW requesters to be retrained, in accordance with the company's defined risk assessment methodology to ensure that all fully understand what is required and how to conduct a risk assessment. Particular emphasis to be placed on identification of control measure, the need for a site visit and the make-up of the risk assessment team.

Average safety communication

4% of adults can understand

← Grade level: 16
Words: 209

Improved communication

68% of adults can understand

Grade level: 5
Words: 91 →

Fixing the Mistakes

1. Planners will decide who does the risk assessments. Put this in the Planner's job description.

2. The person signing the clearance certificate will also inspect the work site.

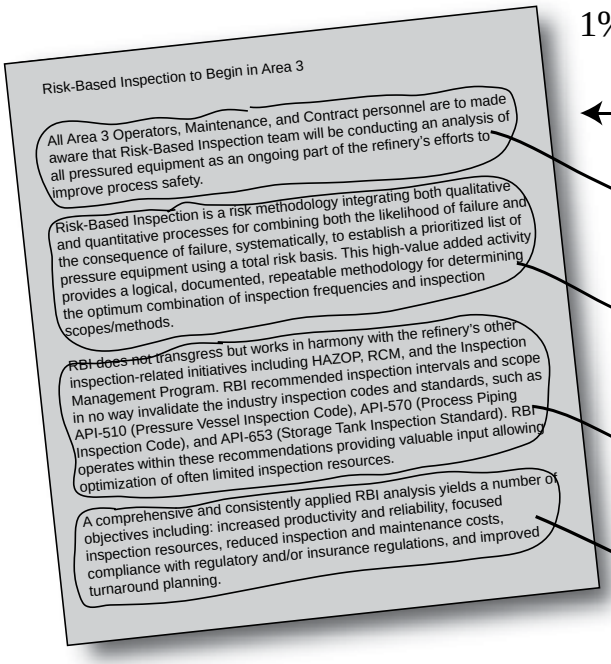
3. Somebody should think of a way to spot bad risk assessments.

4. Supervisors please tell your teams:
   - Every job, even small ones, needs a Work Pack.
   - If the work changes the Pack changes.
   - Risk assessments matter. This person lost his leg.

5. If you can sign a work permit, you must get new risk training.

Some Safety Communication is Bad–Some is Worse

Safety communication at refineries is bad. Sometimes it's worse than bad. Some, we believe, is meant to intimidate. Some communication is meant to separate people: the supposedly "smart" people, who possess this impenetrable vocabulary, from supervisors and frontline employees who don't.



1% of adults can understand

Grade level: 21
Words: 210

Translation: Look out! The big-brain people are coming to Area 3.

Translation: You will probably never understand this–but don't say I didn't try.

Translation: If you think this is impressive–you should see me in my Speedo.

Translation: See, I told you, you wouldn't be able to understand it.

Improved communication

60% of adults can understand

Grade level: 6
Words: 127

15 grade levels lower than the original

New Inspection Team Working in Area 3

They are doing Risk-Based Inspection.
Deciding how frequently to inspect equipment.

They will look at:
All pressured equipment in Area 3.
This includes: piping, vessels, columns, reactors, tanks, pumps, and heat exchangers.

They will give each piece of equipment a risk number.

This risk number comes from two estimates.
#1 Chances this piece of equipment will fail.
#2 How big a disaster that failure would cause.

After all equipment has a risk number, we will know.
The highest-risk piece of equipment in Area 3.
The lowest-risk piece of equipment in Area 3.
And the risk ranking of all equipment in between.

How inspections will change.
More inspections for high-risk equipment.
Same inspections for middle-risk equipment.
Fewer inspections for low-risk equipment.

Many Safety Professionals Are Not Adding Value

Imagine a refinery that pumps in crude from tankers and then, at the other end, pumps out crude to terminals. That's how many safety professionals work.

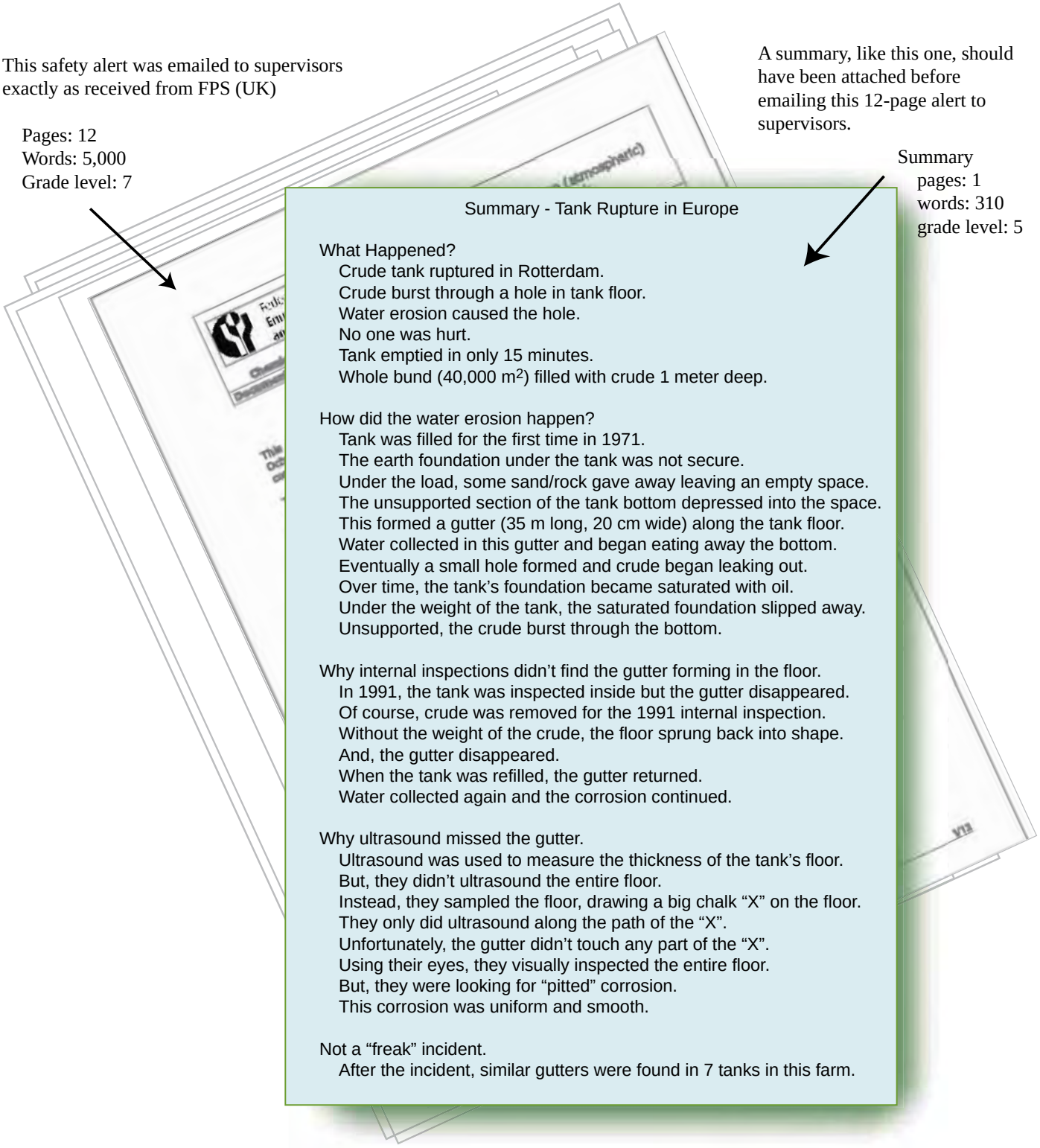
Safety professionals receive communication from the outside (e.g. API, OSHA, CSB) then pump out the exact same communication to refinery supervisors. This is wrong. If communication arrives on the desk of a safety professional, it should leave better than it arrived.

This safety alert was emailed to supervisors exactly as received from FPS (UK)

Pages: 12
Words: 5,000
Grade level: 7

A summary, like this one, should have been attached before emailing this 12-page alert to supervisors.

Summary
pages: 1
words: 310
grade level: 5



Summary - Tank Rupture in Europe

What Happened?
- Crude tank ruptured in Rotterdam.
- Crude burst through a hole in tank floor.
- Water erosion caused the hole.
- No one was hurt.
- Tank emptied in only 15 minutes.
- Whole bund (40,000 m^2) filled with crude 1 meter deep.

How did the water erosion happen?
- Tank was filled for the first time in 1971.
- The earth foundation under the tank was not secure.
- Under the load, some sand/rock gave away leaving an empty space.
- The unsupported section of the tank bottom depressed into the space.
- This formed a gutter (35 m long, 20 cm wide) along the tank floor.
- Water collected in this gutter and began eating away the bottom.
- Eventually a small hole formed and crude began leaking out.
- Over time, the tank's foundation became saturated with oil.
- Under the weight of the tank, the saturated foundation slipped away.
- Unsupported, the crude burst through the bottom.

Why internal inspections didn't find the gutter forming in the floor.
- In 1991, the tank was inspected inside but the gutter disappeared.
- Of course, crude was removed for the 1991 internal inspection.
- Without the weight of the crude, the floor sprung back into shape.
- And, the gutter disappeared.
- When the tank was refilled, the gutter returned.
- Water collected again and the corrosion continued.

Why ultrasound missed the gutter.
- Ultrasound was used to measure the thickness of the tank's floor.
- But, they didn't ultrasound the entire floor.
- Instead, they sampled the floor, drawing a big chalk "X" on the floor.
- They only did ultrasound along the path of the "X".
- Unfortunately, the gutter didn't touch any part of the "X".
- Using their eyes, they visually inspected the entire floor.
- But, they were looking for "pitted" corrosion.
- This corrosion was uniform and smooth.

Not a "freak" incident.
- After the incident, similar gutters were found in 7 tanks in this farm.

The Way You Send It–They Can't Use It

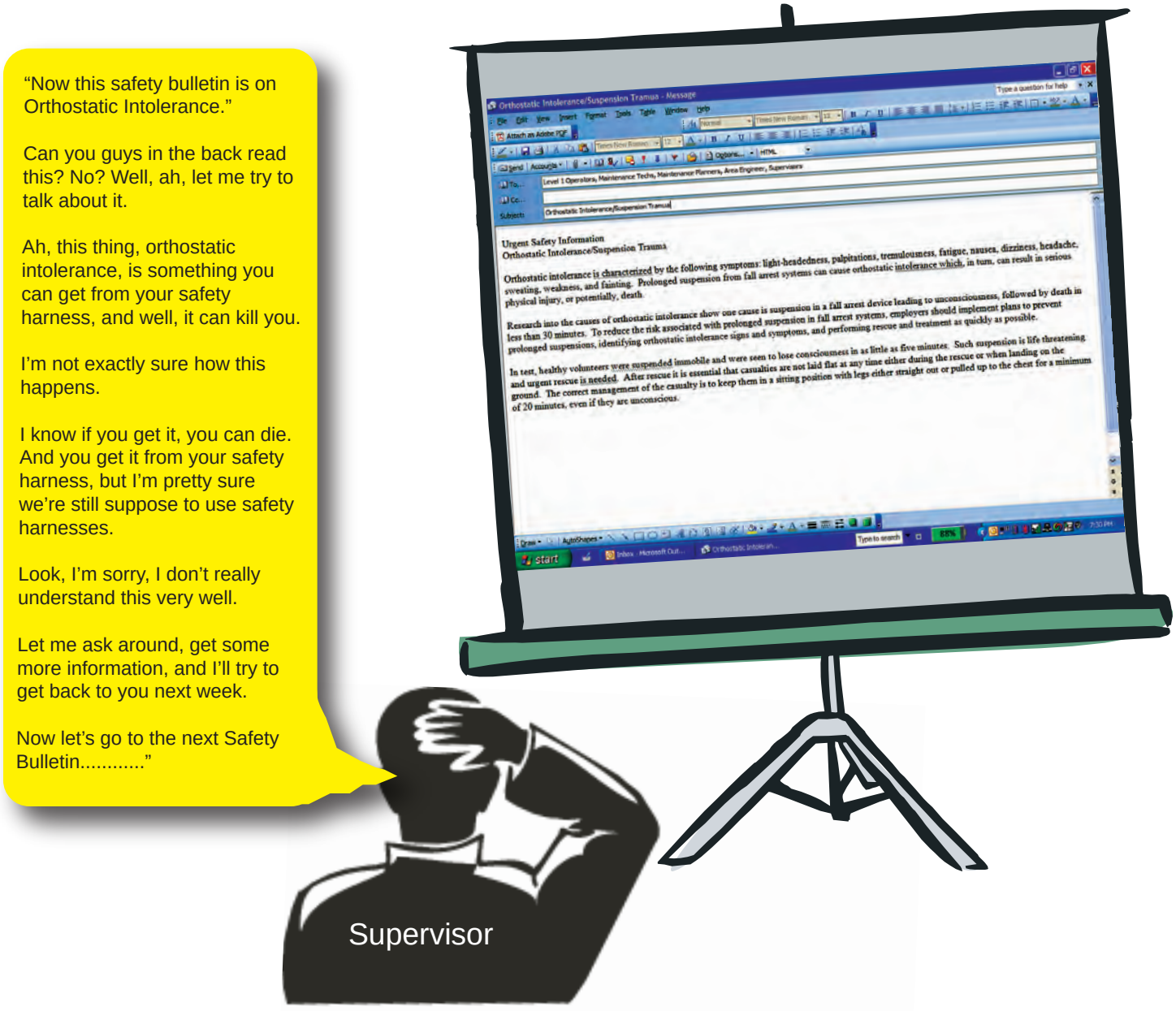
You keep sending text–supervisors need pictures.

We are not talking about throwing in a bunch of pictures to illustrate points in the text. No. We are talking about hand drawing one simple diagram that captures the major points you are trying to communicate.

Do this for two reasons:

1. Pictures dramatically increase comprehension of technical information (often by 100%).
2. Supervisors are projecting your emails onto screens during their safety meetings.

Sending all this text is convenient for safety professionals but hell for frontline supervisors.



This supervisor looks like an idiot in front of his team.

But we are asking you: Who is at fault here? The supervisor, or the safety professional who emailed this page to all the supervisors at his refinery.

Hanging Like This May Kill Him

Surviving the fall is not the only danger
Hanging in the harness is dangerous too

Hanging like this, it takes about...
5 minutes to go unconscious
Less than 30 minutes to die

Get him down quickly
He's not OK

If he's conscious tell him
to keep moving his legs

Legs are the problem:
Blood pools into his legs
If his legs don't move, blood stays there
Heart can't pump blood to his head
First, he faints
Then, he dies

When he's down...
Don't Do This

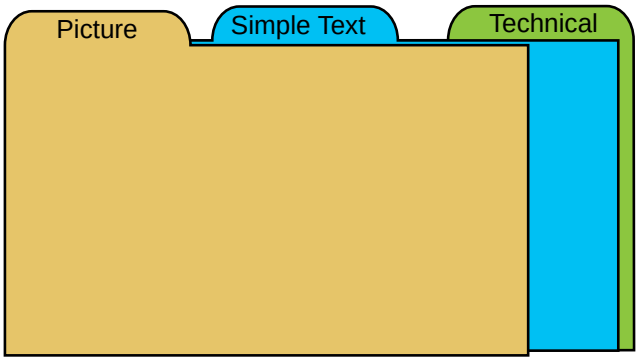
His legs are full of too much "blue" blood.
If all that blood, with no oxgyen in it,
suddenly pours into this heart, it could kill
him.

When he's down...
Sit or Kneel

Don't lay him flat.
Keep him propped up in a sitting position.
No lying down for at least 20 minutes.
Give his heart time to adjust.

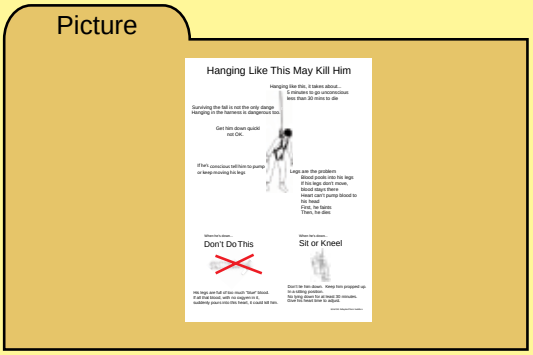
Source: Adapted from Seddon

Good Safety Communication Has 3 Layers



We recommend:

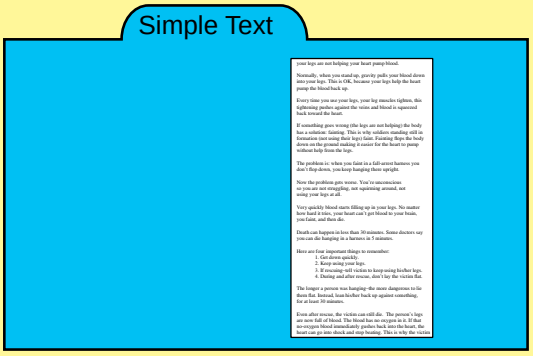
- One PDF document
- Enter three Bookmarks
  1. Picture (use “full screen view”)
  2. Simple Text
  3. Technical Docs
- Attach any kind of file (e.g. Word) using “Attachments” tab



Supervisors will project this picture onto a screen.

Picture captures the major points of the safety message.

For an example (suspension trauma) see page 10.

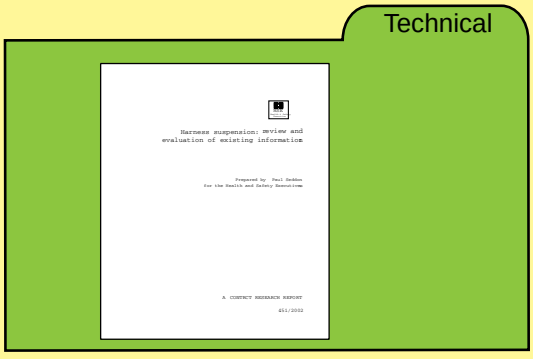


Supervisors read this simple text before the meeting, or more realistically, while walking to the meeting.

This is background information providing a little more depth than the picture. This enables supervisors to speak with more authority and confidence.

- Never more than one page
- Around 200-300 words
- Times New Roman (or similar serif font)
- Grade level 5th to 7th
- 3.5 inch line width
- Lots of white space

For an example (suspension trauma) see page 12.



If supervisors want to go deeper–they can.

These are the technical documents underlying the picture and simple text.

Deliver this with the picture and simple text.

For example (suspension trauma) see: Paul Seddon’s *Harness Suspension: Review and Evaluation of Existing Information.*

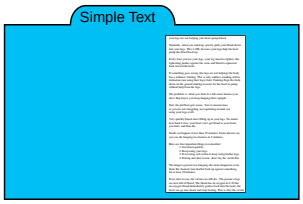
http://www.hse.gov.uk/research/crr_pdf/2002/crr02451.pdf

Simple Text (Example: Suspension Trauma)

68% of people can understand

Grade level: 5
Words: 331

"Simple Text" is the background information enabling your supervisors to confidently discuss the topic in their safety meetings.



Hanging in a fall-arrest harness is dangerous because your legs are not helping your heart pump blood.

Normally, when you stand up, gravity pulls your blood down into your legs. This is OK, because when your legs move they help pump the blood back up again.

Every time you use your legs, your leg muscles tighten, this tightening pushes against the veins and blood is squeezed back toward the heart.

If something goes wrong (the legs are not helping) the body has a solution: fainting. This is why soldiers standing still in formation (not using their legs) faint. When you faint, your body falls to the ground making it easier for your heart to pump without help from the legs.

The problem is: when you faint in a fall-arrest harness you don't fall down, you keep hanging there upright.

Now the problem gets worse. You're unconscious so you are not struggling, not squirming around, not using your legs at all.

Quickly blood begins pooling in your legs. No matter how hard your heart tries, it can't get your blood back up to your brain; you faint, and after a while, die.

Death can happen in less than 30 minutes. Some doctors say you can die hanging in a harness in 5 minutes.

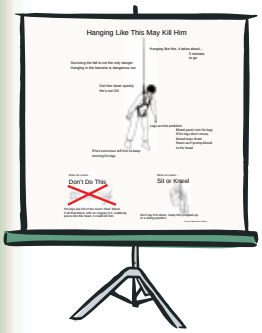
Here are four important things to remember:

1. Get down quickly.
2. Keep using your legs.
3. If rescuing–tell victim to keep using his/her legs.
4. During and after rescue, don't lay the victim flat.

The longer a person is hanging–the more dangerous to lay him/her flat. Instead, lean his/her back up against something, for at least 20 minutes.

Even after rescue, the victim can still die. The person's legs are now full of blood. The blood has no oxygen in it. If all that no-oxygen blood immediately gushes back into the heart, the heart can go into shock and stop beating. This is why the victim must be kept upright during and after the rescue.

This "simple text" is the layer after this picture.



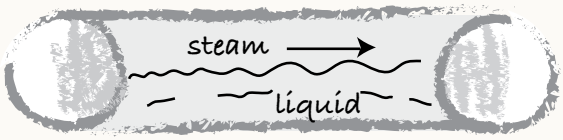
Original email,
"Orthostatic Intolerance" is:
Grade level: 15
7% of population can understand

Use Several Pictures for Complex Processes

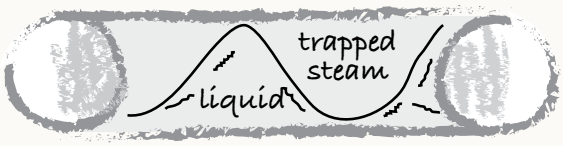
Drawing one picture to describe a complex process is too difficult. A process has several steps so it takes several pictures to describe. This example shows simple hand-drawn pictures explaining condensation-induced waterhammer. Waterhammers are potentially dangerous shock waves that can happen when steam is mixed with a liquid.

Steam Can Explode in a Liquid

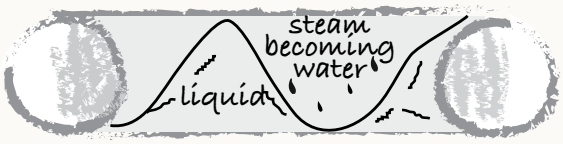
Condensation-Induced Waterhammer



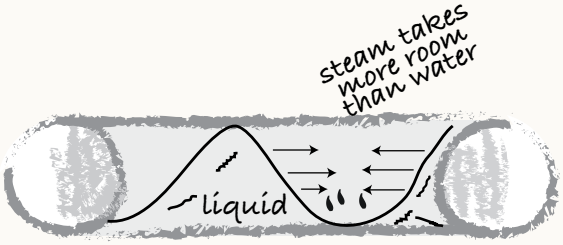
Steam flowing over the top of the liquid causes little waves.



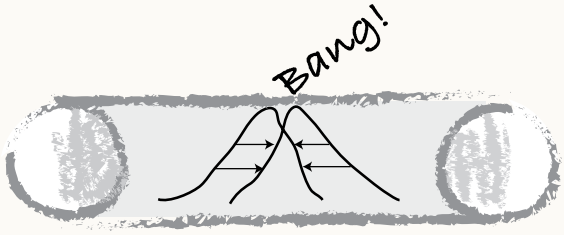
If the waves are high enough, they can touch the pipe walls and create a trapped area of steam.



Since the steam is surrounded by cooler liquid and cooler pipe wall–the steam begins rapidly condensing back into water. This happens in a millisecond.



Steam takes up much more space than water, so as the steam condenses, inside the trapped area, it creates a vacuum.



The vacuum sucks in the surrounding columns of liquid. The liquid columns smash together in an implosion. This sends a powerful shock wave out of the trapped area. These shock waves are called “condensation-induced waterhammers.”

These shock waves can be powerful. In steam systems operating at 80 psi, waterhammers can reach 1000 psi.

Source: adapted from Kirsner

Try Communicating as if You Were Human

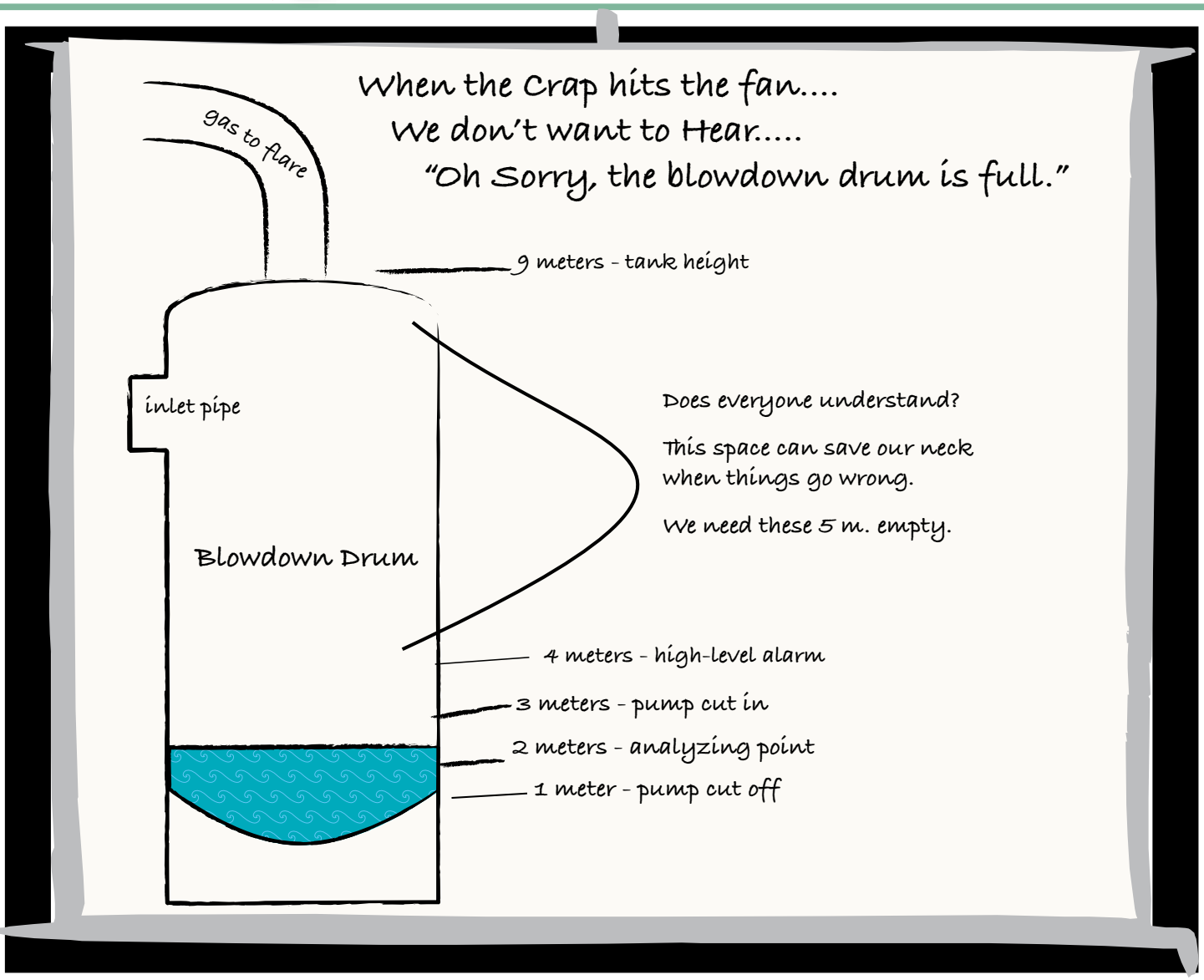
Why does your safety communication always sound like a submission to the *Journal of Chemical Thermodynamics*?

You people are in the grip of some strange pseudo-scientific, pseudo-intellectual communication style. And it's killing you. Literally.

Snap out of it.

Turn your back and walk away from these goofy attempts to sound smart.

Communicate with your supervisors and frontline employees as if you were a human. A real person. Not a pretend scientist or academic.



“But I Can’t Draw”

“I can’t draw” is what everyone says. Get over it.

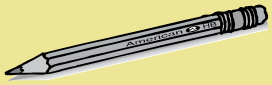
You can’t draw like a professional. Good. You don’t want professional drawings. Professional illustrations and photographs increase attention (more people look at it) but not comprehension.

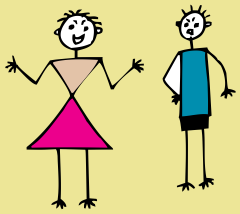
Professional drawings and photographs deliver too much detail. This details becomes noise distracting the reader from the main point.

To maximize comprehension make your drawings crude and simple.

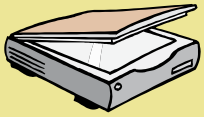
source: Houts

Here is what it takes to improve your safety communication by more than 100%:





This much artistic talent.



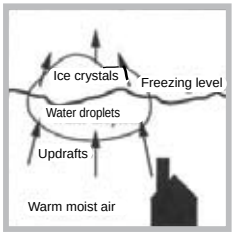
scanner

Few things in communication research are known with certainty, here is one of them:

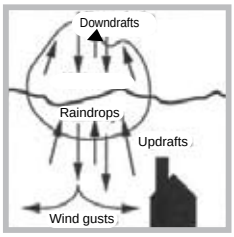
Adding crude drawings to text brings huge increases in comprehension.

source: Paivio

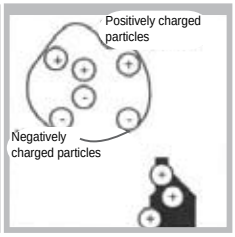
For example, Professor Richard Mayer, University of California, added these five drawings to a 600-word college-textbook explanation of lightning. The result? Students’ test scores jumped by 113%.



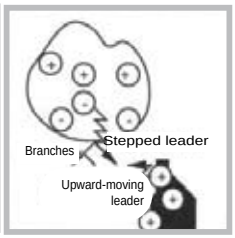
1. Warm moist air rises, water vapor condenses and forms cloud.



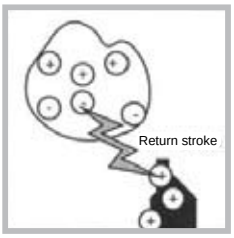
2. Raindrops and ice crystals drag air downward.



3. Negatively charged particles fall to bottom of cloud.



4. Two leaders meet, negatively charged particles rush from cloud to ground.



5. Positively charged particles from the ground rush upward along the same path.

Don’t let some fear of drawing you picked up as a 10-year-old stop you from dramatically improving your safety communication.

Advanced Communication You Shouldn't Try

Oil Refineries are not ready for advanced communication. Refineries need to master the basics first. Mastering the basics means safety messages with three layers: picture, simple text, and then technical documents. (See page 11). However, here is a taste of three advanced communication techniques.

1. Fear Appeals

This ad did not work.

Fear appeals can change behavior and refineries are the perfect place to use them.

Fear appeals, however, require a balance: the amount of fear must equal the ease of the solution.

If you deliver a high fear-appeal message without an easy-to-do solution, people reduce the fear by suppressing the message ("I don't believe it" "never happen to me" "that's exaggerated").

This is why years of terrifying anti-smoking ads failed. Smokers (70% of whom had already tried and failed to quit) did not see an easy solution–so they reduced their fear by suppressing the message. For this same reason fear appeals are not used for losing weight.

On the other hand, fear appeals work well in car safety (seat belts), dental care (flossing), AIDS (condoms) because you can reduce the fear by doing the relatively easy solution.

Refineries are perfect for fear appeals because there are plenty of reasons to be afraid and many of the solutions are easy to do.

Sources: Keller, Witte

2. Communication Campaigns

Communication campaigns can tap the collective consciousness of a group.

Refineries are perfect for communication campaign because people know each other well, work in close proximity, and depend heavily on one another. These conditions breed a collective consciousness exerting considerable influence on everyone's behavior.

A good communication campaign inserts your safety message into the collective:

Choose one topic relevant across the refinery: new permit system, evacuation procedures.
Logo: prepare something clever capturing the major theme of the campaign.
Big-bang launch flooding the refinery with: pins, coffee mugs, hats, and posters.
Knowledge booklet for everyone: 10 to 15 pages explaining the new safety procedures.
After one week, employees take a 20-question test on the material in the booklet.
Substitute teachers, usually from a specialist temp. agency, arrive at your refinery.
These teachers randomly select employees for testing, then administer and score the tests.
These teachers aggregate anonymous individual scores into a refinery score.
The refinery must reach 80% correct answers or a re-test is scheduled for the next week.

A well-executed communication campaign embeds your safety message into the entire refinery.

3. Improved Channel Selection

Web
best for search

Face to Face
best for change

Paper
best for comprehension

Your safety communication does not show a good understanding of communication channels. Especially what each channel does best:

Web: best for searching–locating small pieces of information within large data sets.
Paper: best for comprehending–understanding new, long, and complicated ideas.
Face to face: best for overcoming employee resistance to change.

Web pages are not best for comprehension because the mind is busy juggling two tasks: navigating and understanding. This is supported by research showing the more links on a Web page, the lower the comprehension. Paper is superior to Web for comprehension because there is no navigation, all mental resources can be devoted to understanding.

Finally, mediated information (print and electronic) is good for creating awareness but not best for behavior change. Face-to-face communication with a supervisor is about ten times more powerful than mediated information for changing employee behavior.

Sources: Hailey, Larkin

Larkin Communication Consulting

Dr TJ Larkin and Sandar Larkin began Larkin Communication Consulting in 1985.

For more than 20 years the Larkins have been helping large companies improve communication with employees.

Their clients include: ABB, Boeing, BP, Caltex, DaimlerChrysler, ExxonMobil, ICI, GM, NASA, National Oilwell Varco (NOV), Shell and mining companies: BHP Billiton and Rio Tinto.

TJ has a Ph.D. in communication (Michigan State University) and a B.Phil. in sociology (University of Oxford). Sandar, born in Burma, educated in Australia, began her career with the Long Term Credit Bank of Japan. Larkin Communication Consulting is based in New York City.

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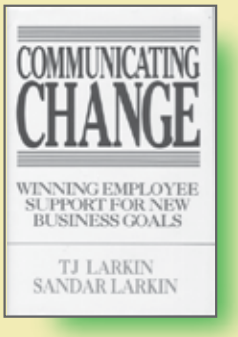

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TJ Larkin & Sandar Larkin
McGraw-Hill, New York, 1994
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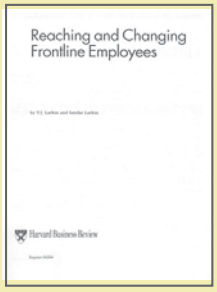

"Reaching and Changing Frontline Employees"
TJ Larkin & Sandar Larkin
Harvard Business Review
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Working With the Larkins

Contracts	*Time*	*Description*
Presentation	60-90 minutes	What's wrong with safety communication and how to fix it. Shows both good and bad examples. Uses communication research to explain why the good is good–and why the bad is bad. Uses examples from our consulting experience. Or, if you prefer, send us samples of your safety communication, and we will use those.
Workshop	6 hours Can be one day (morning and afternoon) or Separated into 2 days (3 hours each day)	More hands-on than the presentation. Short mini-presentations (about 15 minutes) immediately followed by an exercise (about 45 minutes). It takes one hour to complete a mini-presentation plus exercise. Each mini-presentation shows a big problem in safety communication and how to fix it. During each exercise, the participants re-do a piece of safety communication applying the principle shown in the mini-presentation. We can use examples from our experience. Or, if you prefer, send us samples of your safety communication, and we will use those.
Implementation	2-weeks	We move into a location of your choice. You select a small team of in-house safety professionals. We join that team. Together we begin doing your safety communication. These are real safety topics delivered to your refinery employees. After each communication, we speak with your supervisors and frontline employees, and we go to safety meetings, checking on the success of the communication. We use this frontline input the next day to improve the next safety communication. This is the best way to improve communication.

Each contract has a fee. Send us an email and we will send you the fees (Larkin@Larkin.biz).

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