Ammonia Fuel Safety

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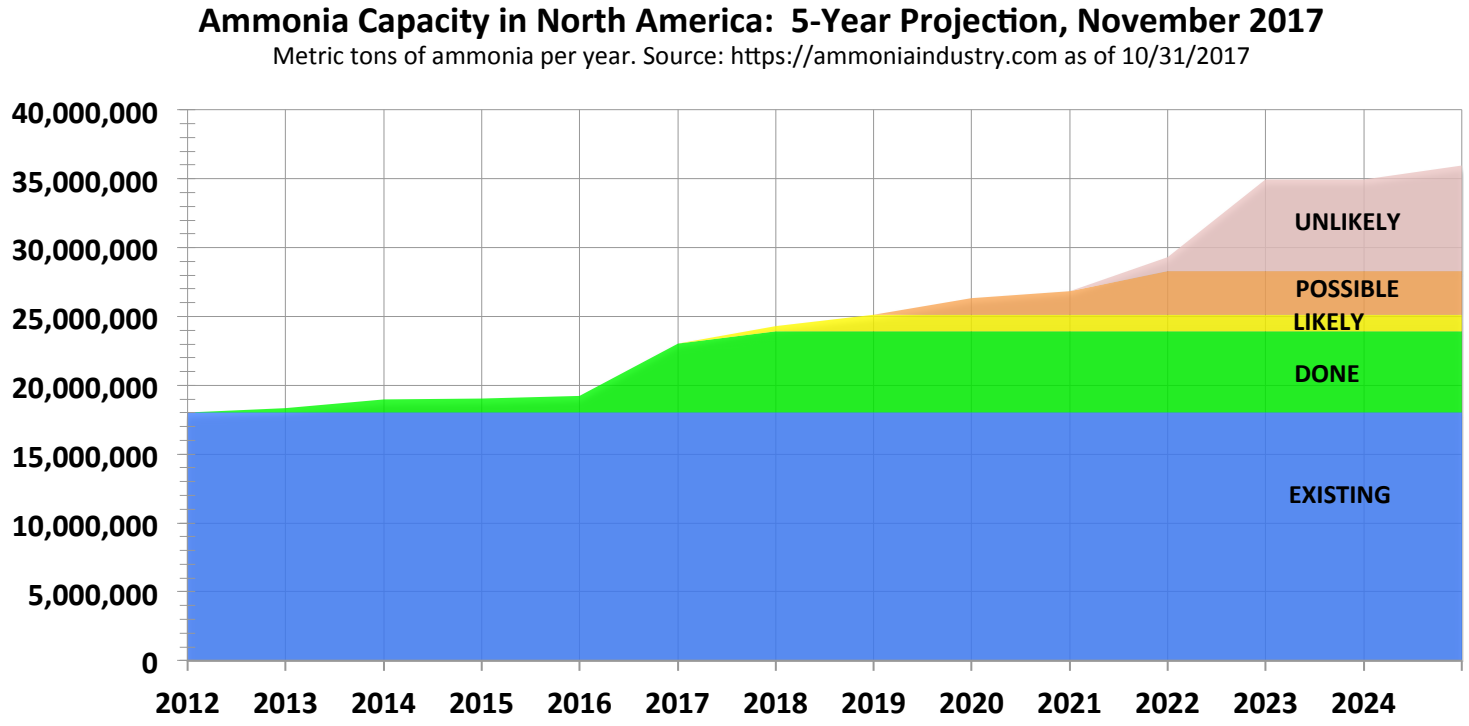
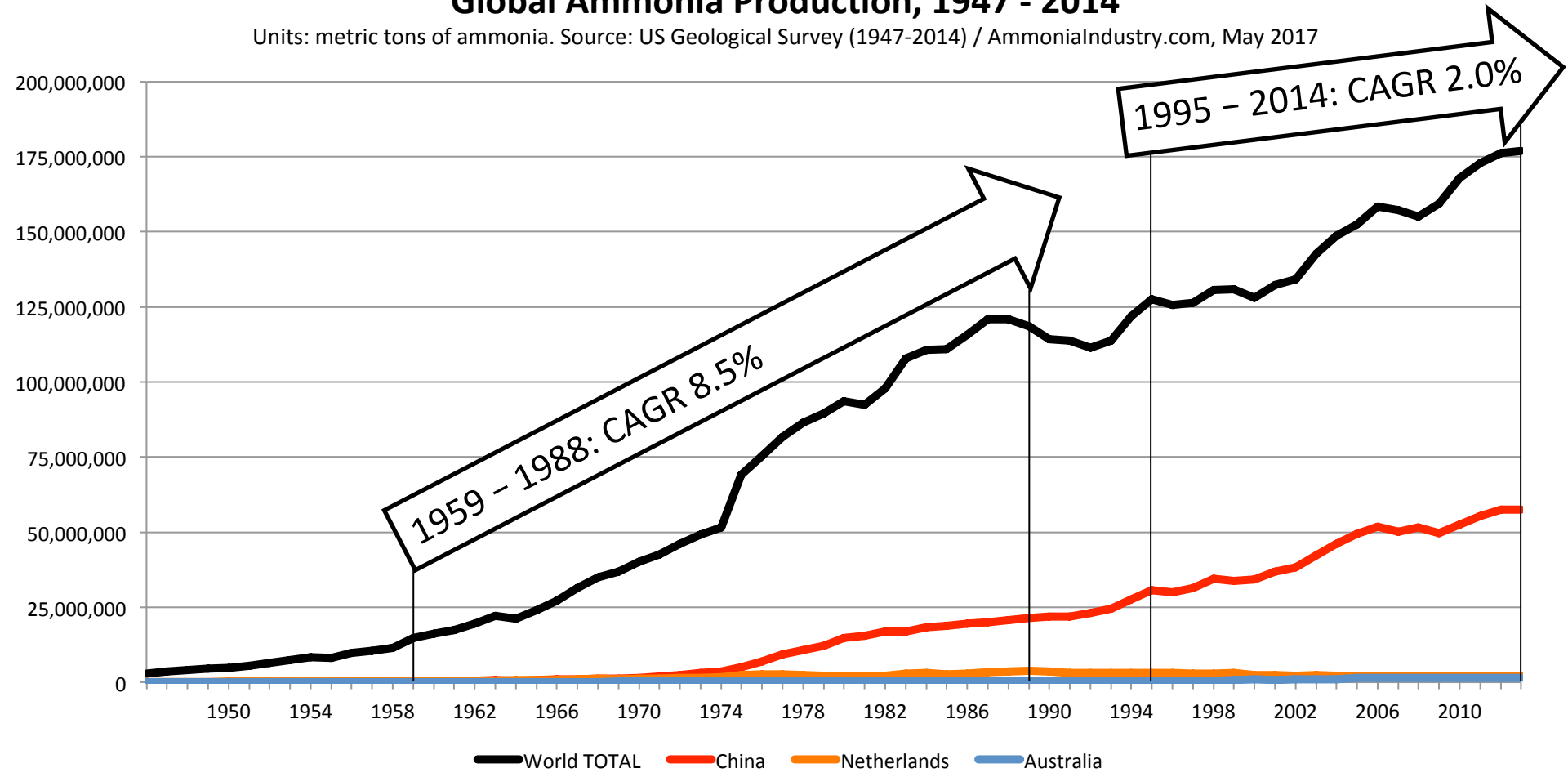
AmmoniaIndustry.com



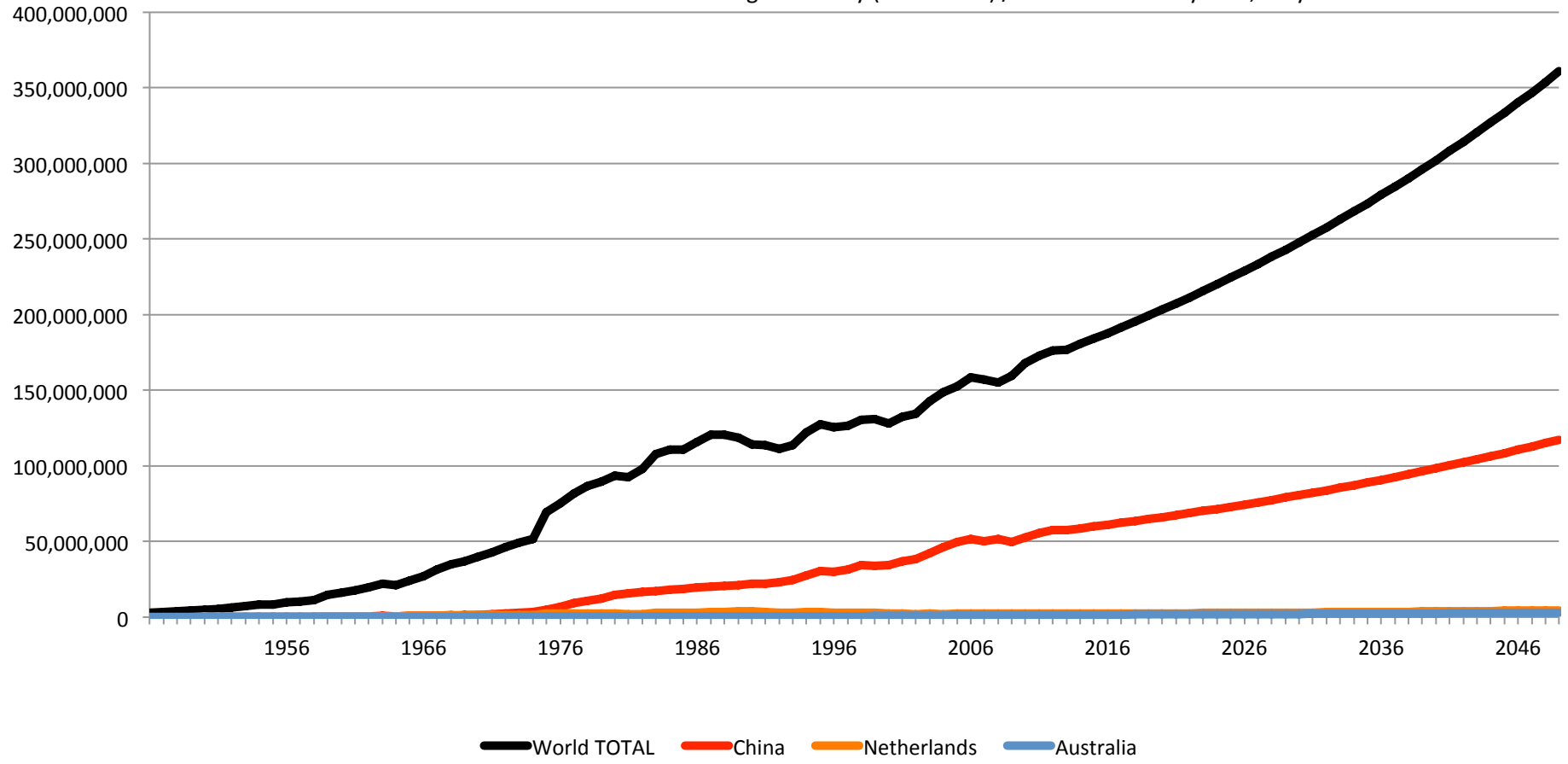
Global Ammonia Production, 1947 - 2014

Units: metric tons of ammonia. Source: US Geological Survey (1947-2014) / AmmoniaIndustry.com, May 2017



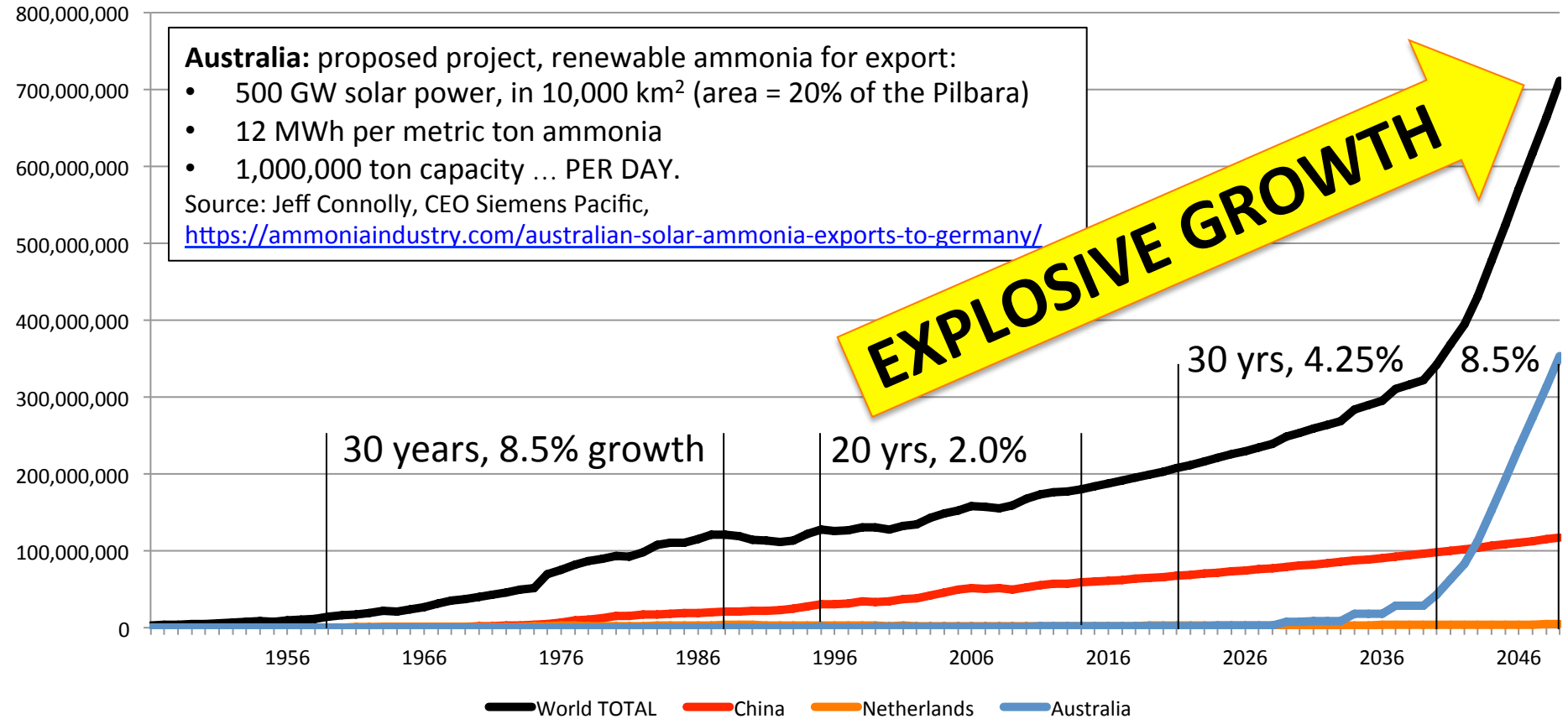
Global Ammonia Production, forecast to 2050 @ 2% compound growth

Units: metric tons of ammonia. Source: US Geological Survey (1947-2014) / AmmoniaIndustry.com, May 2017



Global Ammonia Production, forecast to 2050 @ export strength

Units: metric tons of ammonia. Source: US Geological Survey (1947-2014) / AmmoniaIndustry.com, May 2017



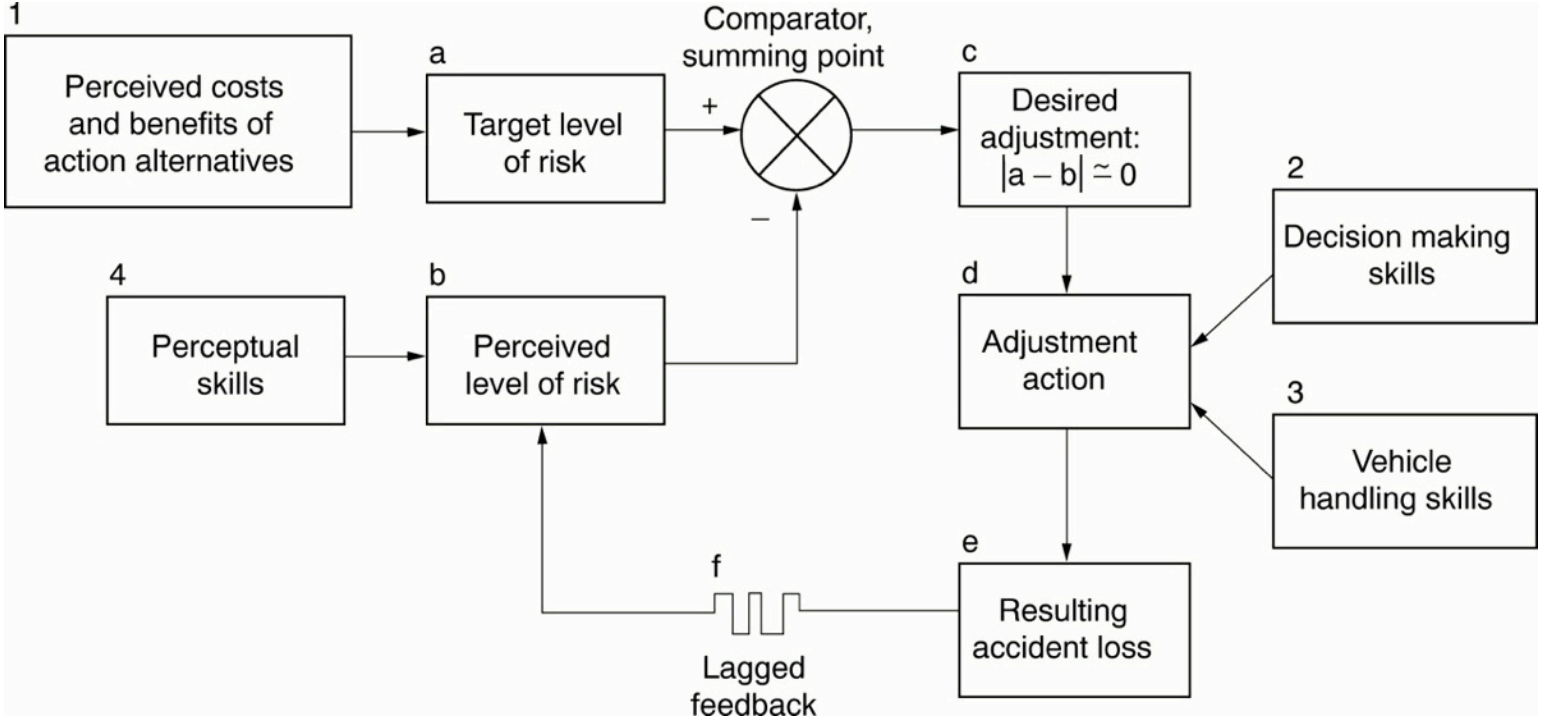
Vice President Mahamudu Bawumia visited the site of the accident early Sunday where he pledged that the government would work to curb such tragedies.

"Eight of these explosions in three years is too much," he said while at the LNG filling station near Legon, a suburb of Accra.
Chicago Tribune, October 8, 2017


2 Av
TOWER LADDER 1
FD NY
FDNY


2 AV

Risk Homeostasis Theory



Ammonia Fuel Safety: Two studies

Comparative Quantitative Risk Analysis of Motor Gasoline, LPG, and Anhydrous Ammonia as an Automotive Fuel

Quest Consultants Inc, USA
2009

LINK:
http://nh3fuel.files.wordpress.com/2013/01/nh3_riskanalysis_final.pdf

Safety Assessment of Ammonia as a Transport Fuel

Risø National Laboratory, Denmark
2005

LINK:
http://nh3fuel.files.wordpress.com/2013/05/riso-ammonia-transport-safety-report.pdf

Ammonia Fuel Safety: Two studies

Quest:

"In summary, the hazards and risks associated with the truck transport, storage, and dispensing of refrigerated anhydrous ammonia are **similar to those of gasoline and LPG** ...

The risks associated with all three fuels would fall into the **acceptable** category for all referenced risk criteria."

Quest: p. 53 of 59 (6-13)

Risø:

"An overall conclusion is that the hazards in relation to ammonia need to be (and probably can be) controlled by technical and regulatory options ...

When these safety systems are implemented, the risks of using ammonia is **similar, if not lower than** for the other fuels."

Risø: pp. 39-40 of 160. Compares ammonia to gasoline, LPG, CNG, methanol, and hydrogen – in internal combustion engines or fuel cells.

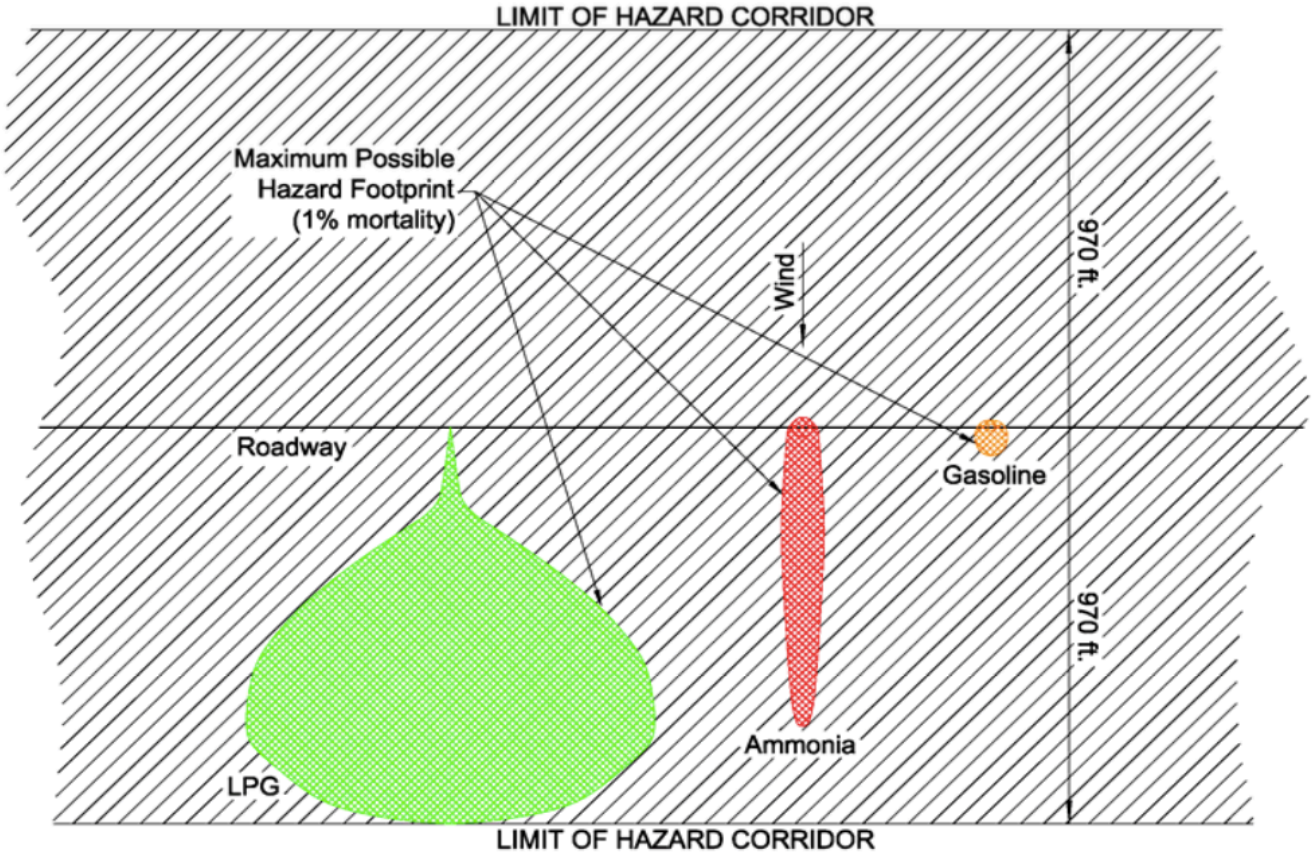


Figure 6-2
Vulnerability Corridors and Zones for the Truck Transport of Gasoline, LPG, and Refrigerated Ammonia

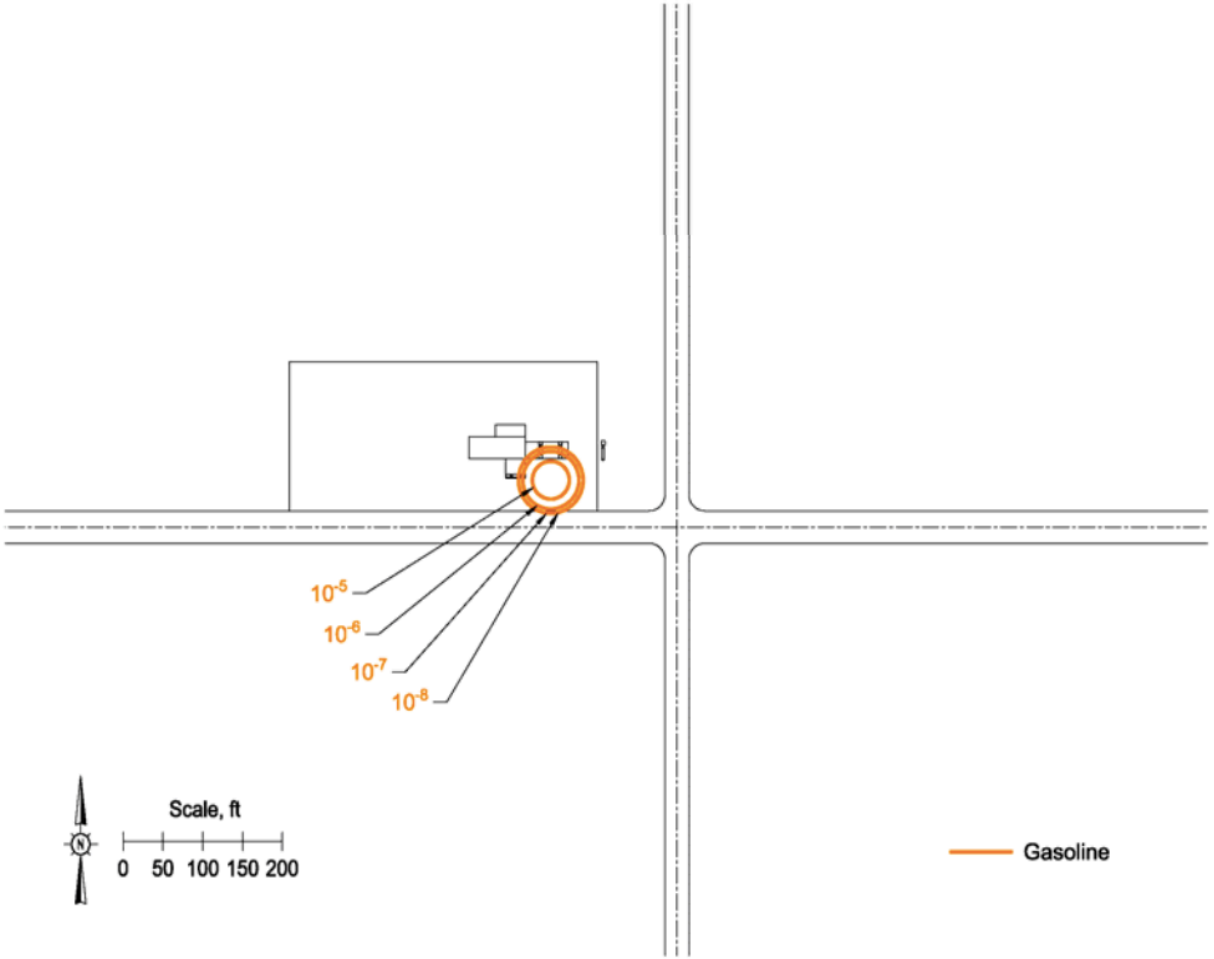


Figure 6-4
Risk Contours for a Service Station Storing and Dispensing Gasoline

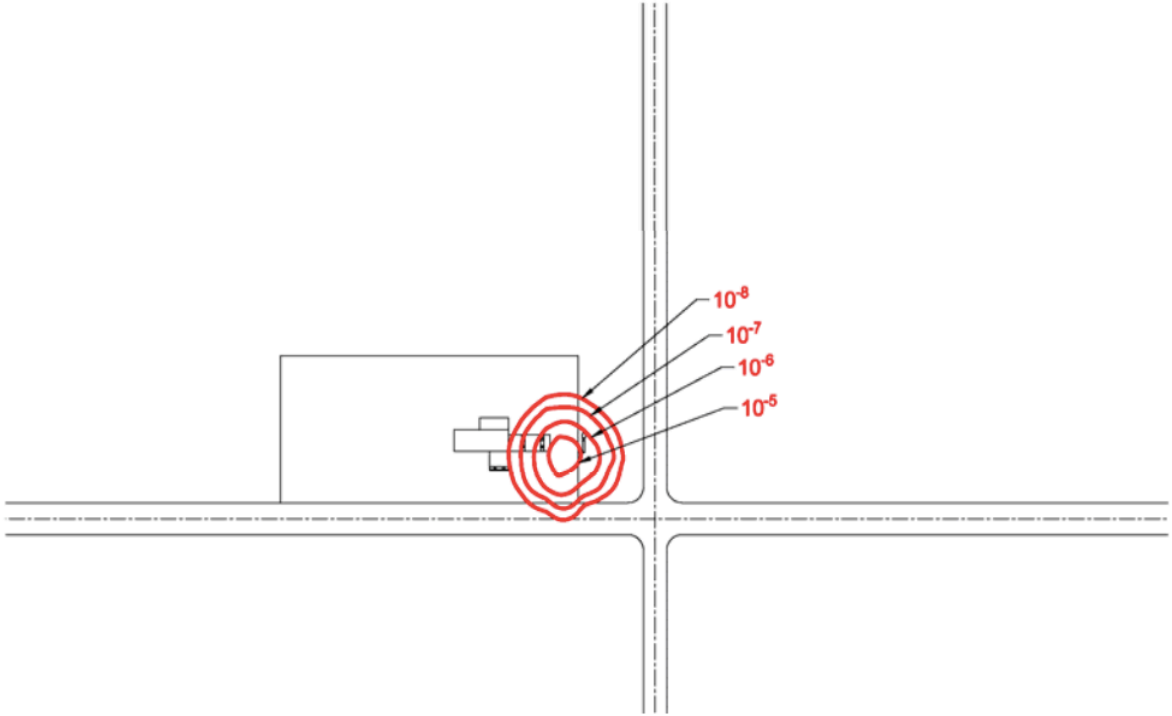


Figure 6-6
Risk Contours for a Service Station Storing and Dispensing Anhydrous Ammonia

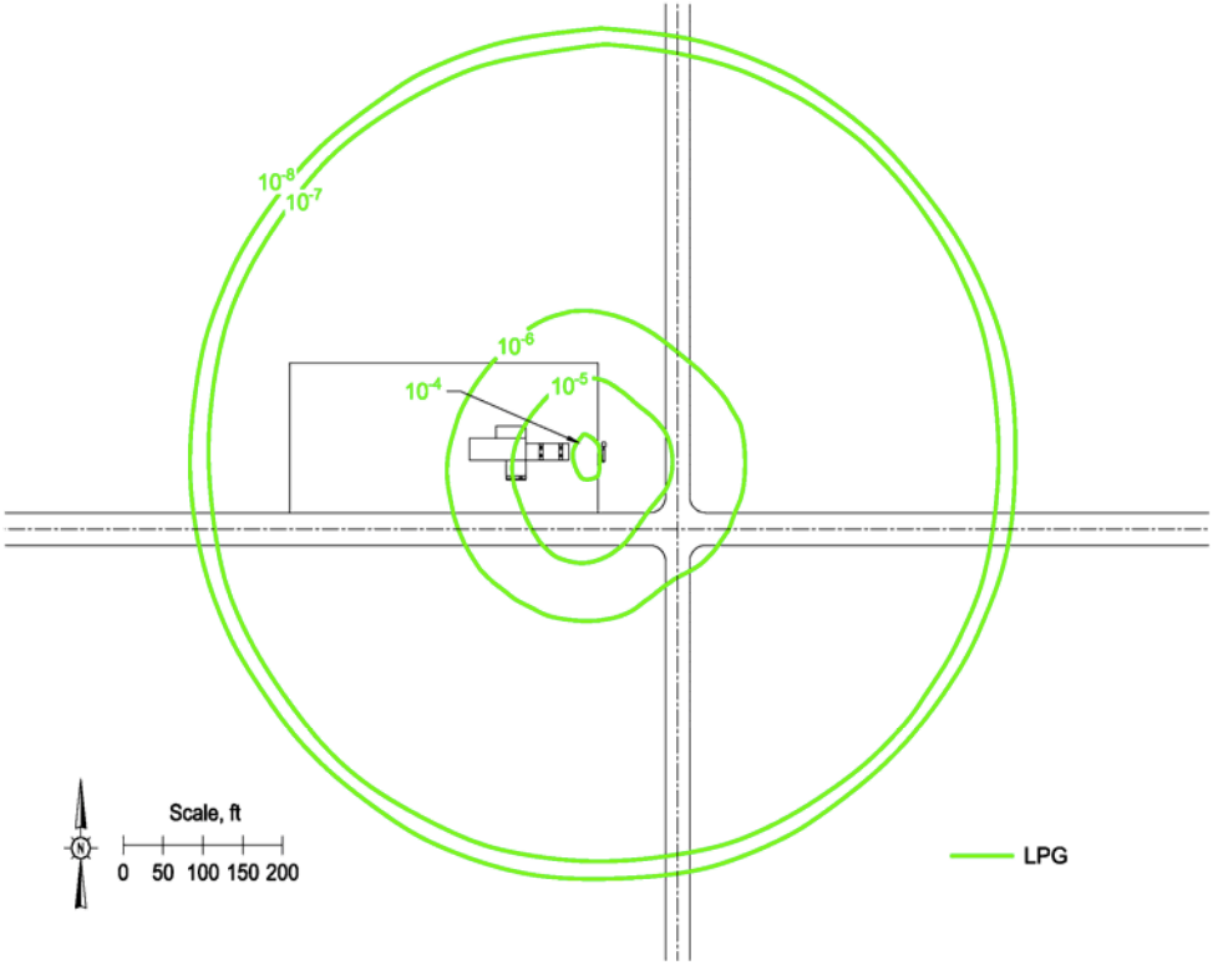


Figure 6-5
Risk Contours for a Service Station Storing and Dispensing LPG

Ammonia Fuel Safety: Conclusions

Risø:

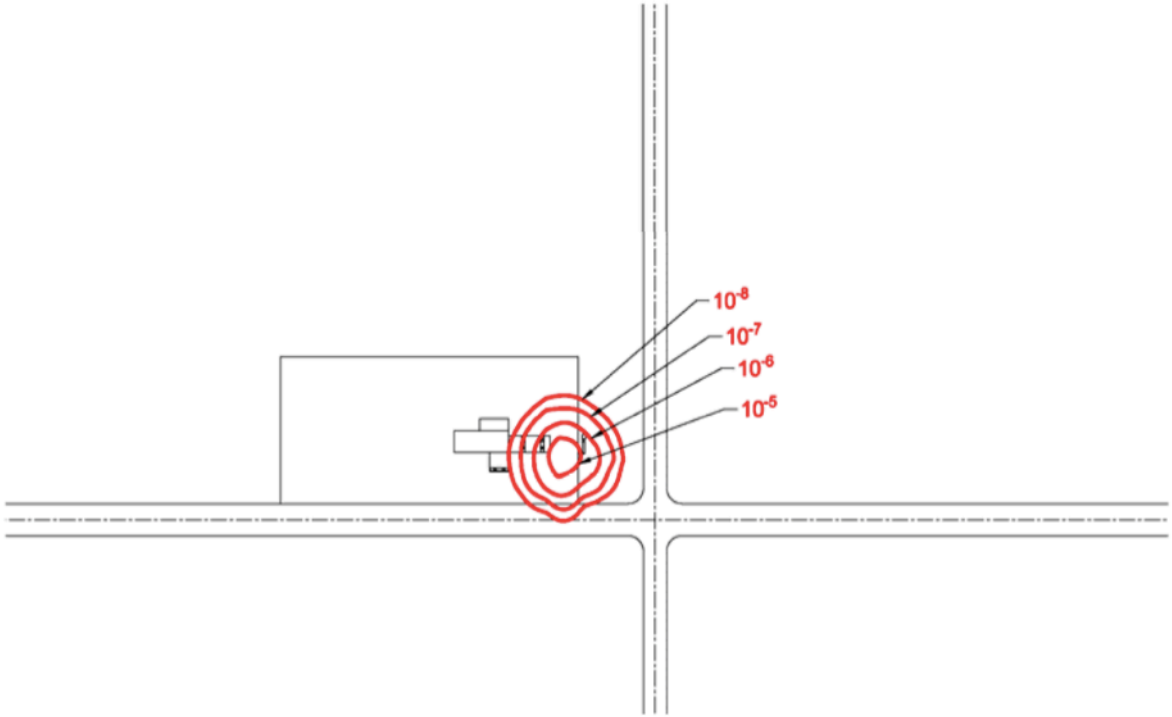
"The acceptance of ammonia will not be based on the results of numerical risk analysis, but will also be influenced by the public's perception of the threats of ammonia."

Risø: p. 40

Dave Garman:

"Ammonia isn't sexy. It just works."

David Garman, former Under Secretary of Energy, US Department of Energy
The Curse of Shiny Objects, NH3 Fuel Conference, 9/21/2015.



What additional investment to make these circles smaller?