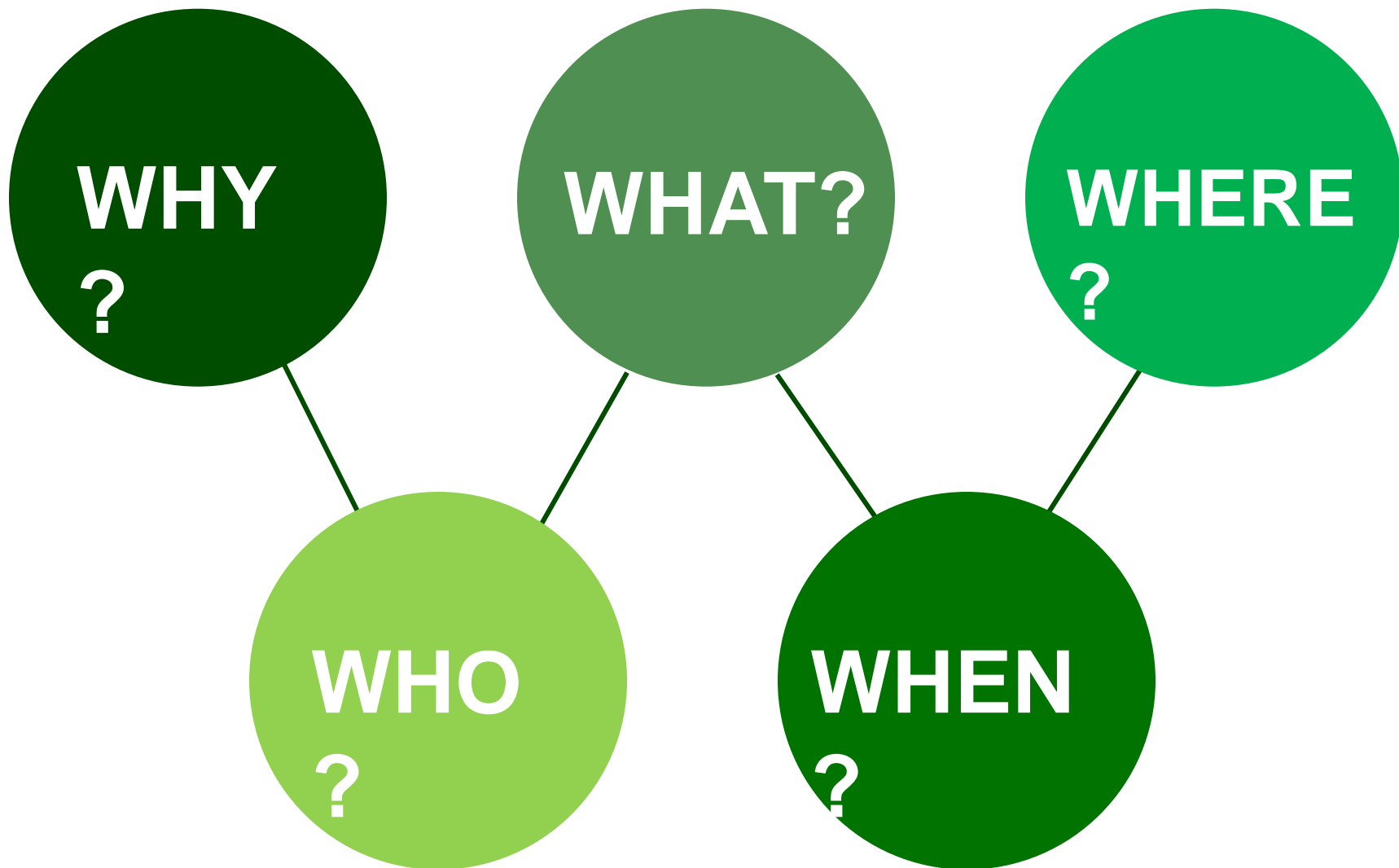

Natural Refrigerant Conversion Roche's Journey to eliminate halogenated hydrocarbons

Krista McKenna



Introduction to Roche Diagnostics





WHY

?

Why are halogenated hydrocarbons being replaced?

Refrigerant	Global Warming Potential (GWP)
R-12, CFC	10,200
R-410a, HFC	2,088
R-134a, HFC	1,300
R-290, Propane	3
R-744, Carbon Dioxide	0
R-717, Ammonia	0

*The GWPs listed are from the IPCC's Fifth Assessment Report, published in 2014.

EPA's Clean Air Act Banned and Restricted List

Class 1 Substances

- Chlorofluorocarbons (CFCs)
- R-11, R-12, R-113, R-502
- Developed in the 1930's for industrial, commercial, and household, and automotive applications.
- Banned from production and import in 1994

Class 2 Substances

- Hydrochlorofluorocarbons (HCFCs)
- R-401A, R-402A, R-409A, R414B
- Banned from production and import, except those used in equipment manufactured before January 1, 2020.
- Banned from production and import in 2030.

EPA Significant New Alternatives Policy (SNAP)

A vertical flow diagram illustrating the EPA SNAP process. It features three white circles connected by a blue line on the left side. Each circle is followed by a horizontal bar of a different color (green, teal, blue) containing text. The bottom circle is followed by a light blue box containing a list of industry sectors.

Evaluates the environmental impact for alternative refrigerants

Approves refrigerant materials for specific end uses

Substitutes are evaluated by industry sector

Refrigeration and Air Conditioning | Foam Blowing Agents | Cleaning Solvents | Fire Suppression and Explosion Protection | Aerosols | Sterilants | Tobacco Expansion | Adhesives, Coatings, and Inks

WHO?

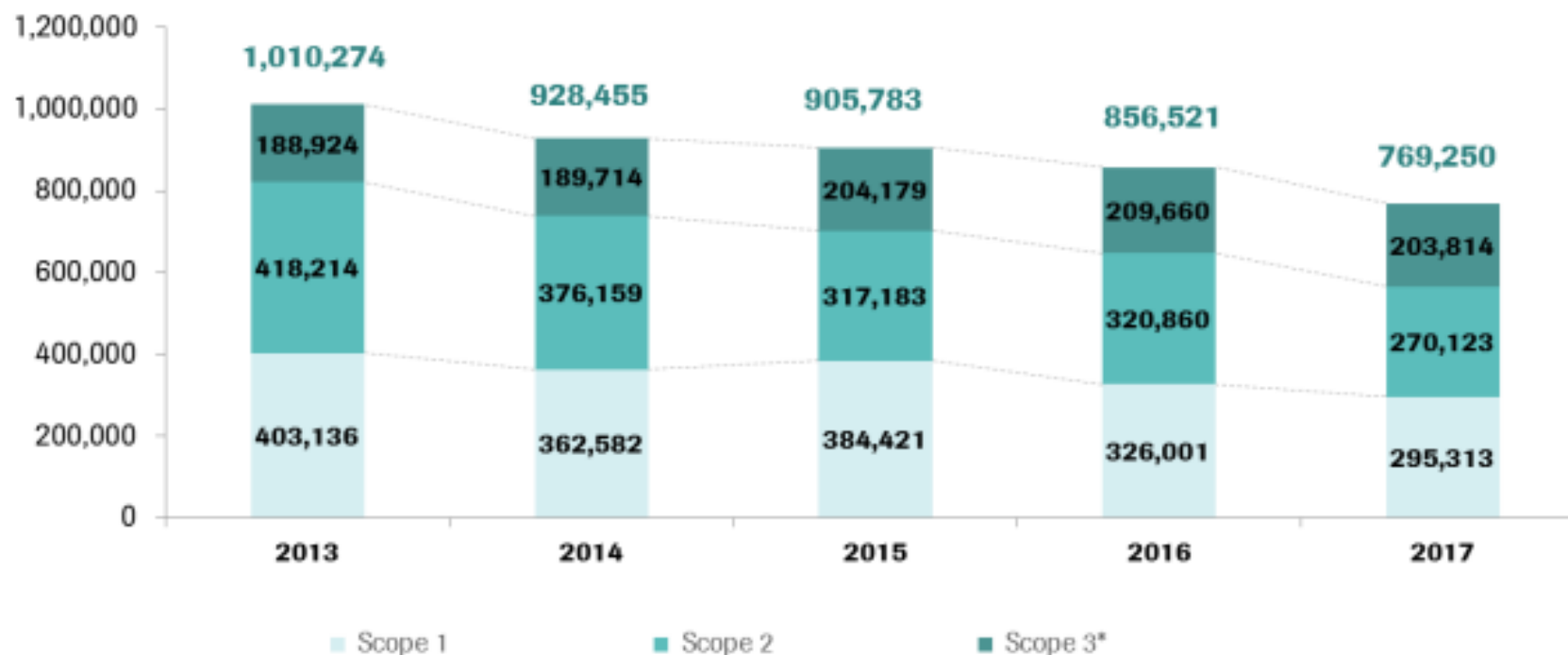
Sustainability Matters

The three elements of sustainability – society, environmental and economic – are interdependent. We will not be successful in the long term without meeting our environmental and social responsibilities. Equally, we cannot contribute to society and environmental protection without economic success.

Severin Schwan,
Roche CEO



CO2 Equivalent Emissions in Tons



Maintaining awareness of the importance and urgency to address climate change as one of the largest global risks, we are acting towards a low-carbon future. Delaying actions is not preferred, as this is likely to necessitate more dramatic, more disruptive, more expensive changes in the future.

Sustainability Recognition



Basel, 07 September 2017

Roche ranked again the most sustainable healthcare company in the Dow Jones Sustainability Indices

- ◆ **Roche recognised as a sustainability leader for the ninth year in a row**
- ◆ **Sustainability is an integral part of Roche's business strategy**
- ◆ **The company performed particularly well in the categories addressing the burden of healthcare costs, ethical marketing practices and climate strategy**



Basel, 24 October 2017

Roche recognised as a global leader for sustainable water management

- ◆ **Sustainability is an integral part of Roche's business strategy**
- ◆ **The company's goal is to reduce water consumption by 10% per employee by 2020**

Roche's commitment to Environmental Sustainability

Corporate Directives

- Encourage recycling and favor incineration over landfilling of waste
- Energy conservation management
- Product sustainability
- Water management
- Use of natural refrigerants that do not affect the ozone



WHAT?

Use of Natural Refrigerants

Roche Directive initiated in December 2002

Commitment to reduce hydrogen halocarbon refrigerants to 90% or less by 2015

Primary Focus

- Removal of CFC, HCFCs, and HBFCs
- Examples: R-11, R-22

Secondary Focus

- Removal of HFCs and PFCs
- Examples: R-134a, R-410a

Promoted use of natural refrigerants

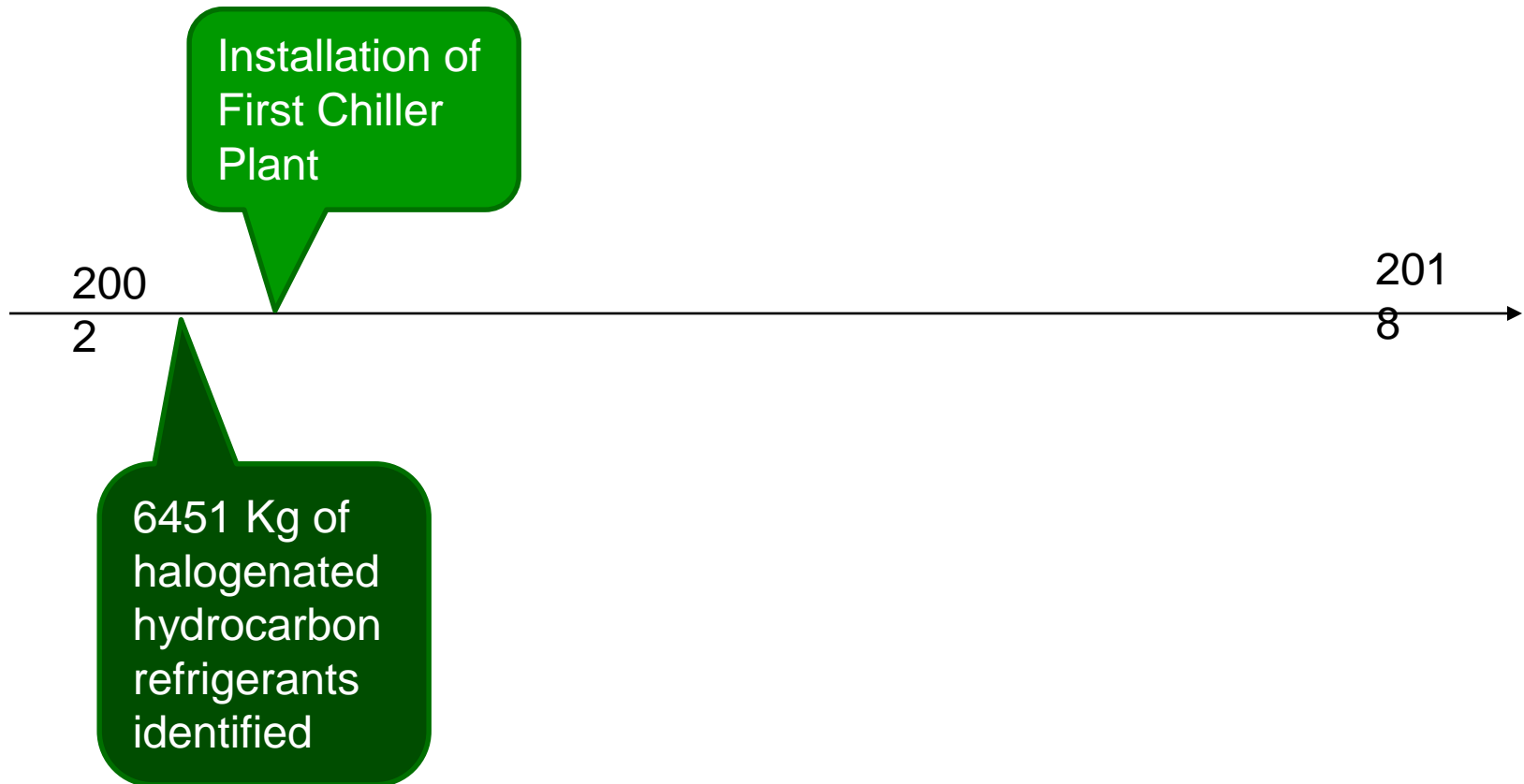
- Ammonia
- Carbon Dioxide
- Hydrocarbon Refrigerants (Ethane, Propane, Iso-propane)
- Water

Equipment converted

- Air Conditioning/Comfort Cooling space
- Stability chambers for testing and storage
- Cold storage space
- Cafeteria equipment
- Fire suppression systems
- Packaging foam
- Small items such as break area refrigerators and water fountains

WHEN?
WHERE?

The Timeline of the Natural Refrigerant Conversion

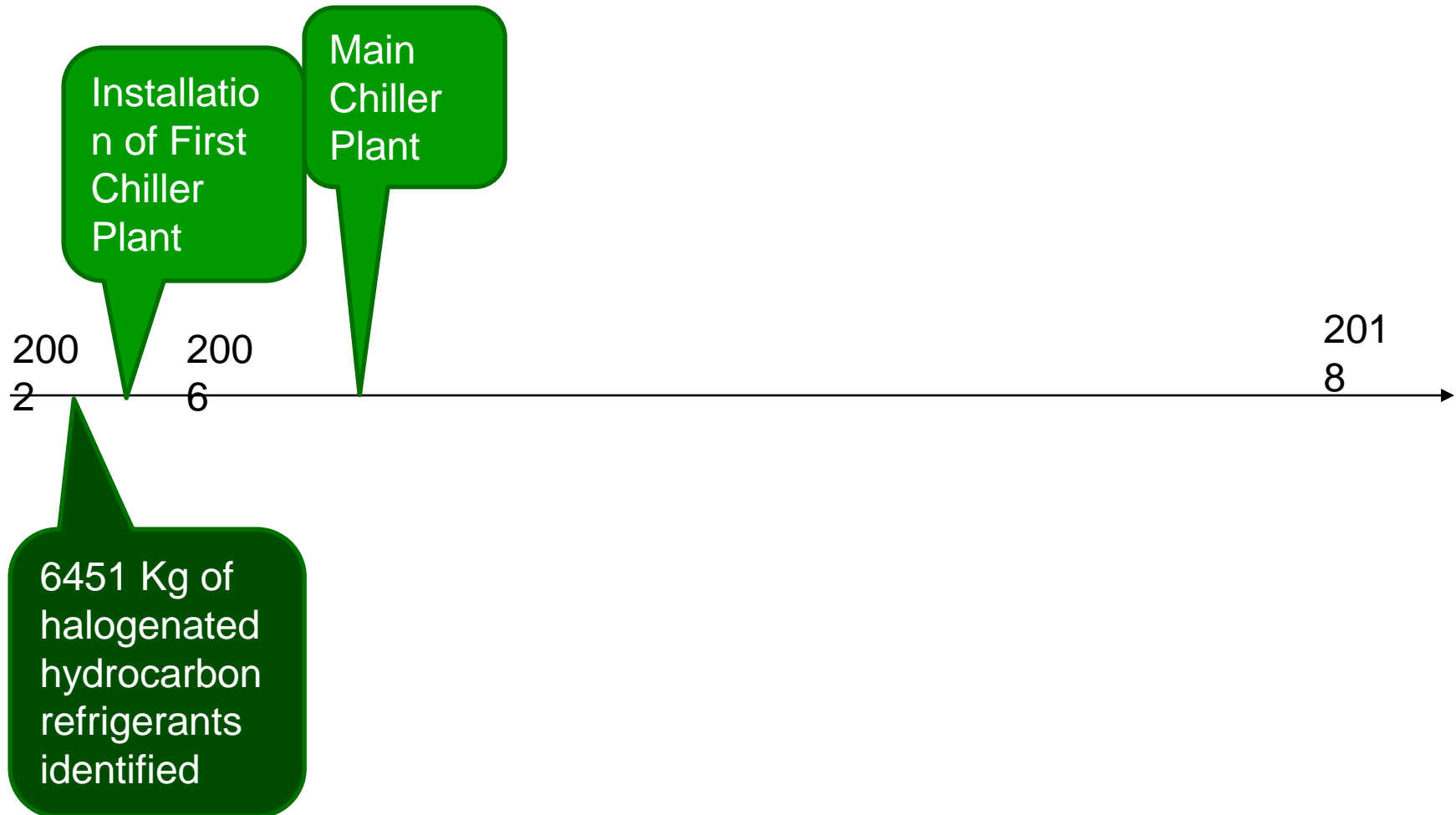


First Ammonia Chiller Plant



- First US Roche site to install an ammonia system
- Used to cool a chilled water loop for production
- 3 Frick chillers, 100 lb of ammonia, (R-717) each
- Offer 600 tons of cooling capacity

The Timeline of the Natural Refrigerant Conversion

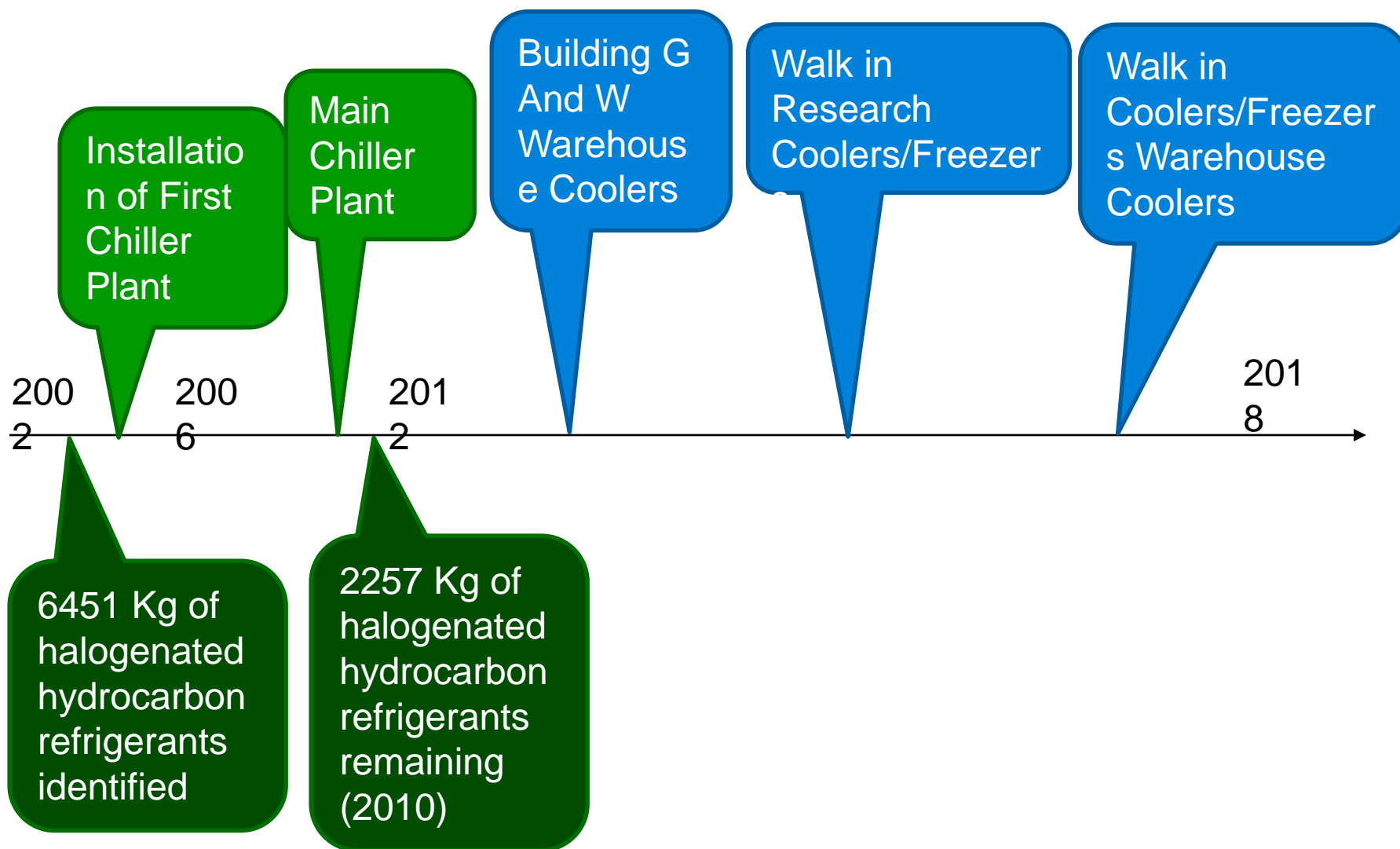


Central Chiller Plant



- Supplies the chilled loop to the Campus Buildings
- 7 Frick chillers, 420 lb of ammonia (R-717) each
- Offer 4,550 tons of cooling capacity

The Timeline of the Natural Refrigerant Conversion



Warehouse Coolers



Building G warehouse cooler

- 3,480 ft² of storage capacity
- 60 lbs of Carbon Dioxide, R744



Building W1 Warehouse cooler

- 18,715 ft² of storage capacity
- 60 lbs of Carbon Dioxide, R744



Building W1 cooler uses chilled water from an ammonia system and Carbon Dioxide, R-744.

Walk in Coolers and Freezers for Laboratory Research and Food Storage



- 10 walk in coolers/freezers in Buildings D, J and R
- Coolers/Freezers for the cafeteria and storage for research work.
- Carbon Dioxide, R744 systems with 12-15 lbs each.



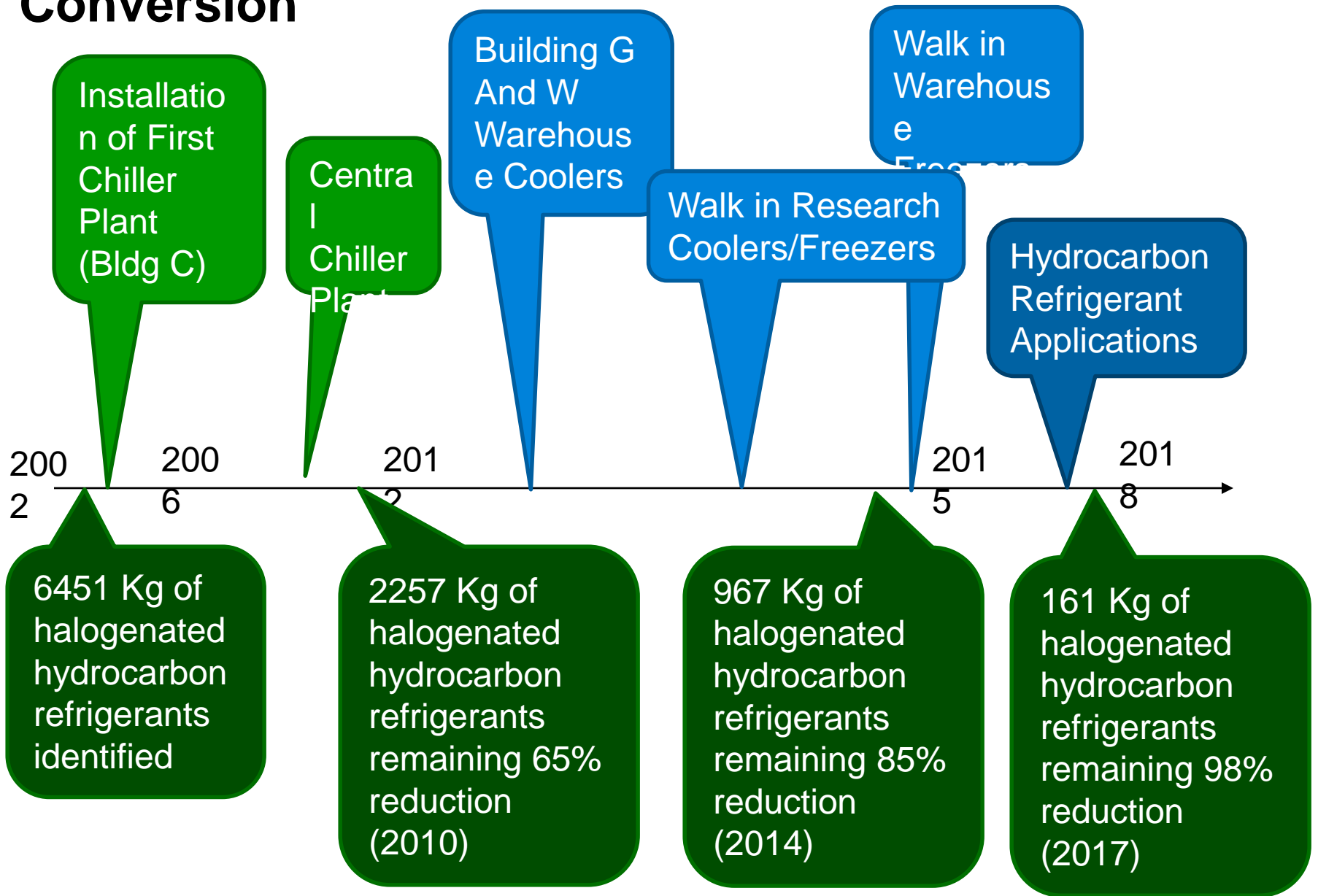
Walk in Freezers for Warehouse



- Walk in freezers at -20°C
- 1000 lbs of Carbon Dioxide, R-744 combined in three separate walk in systems
- 64 Tons cooling capacity
- 2,175 ft² of cooling space



The Timeline of the Natural Refrigerant Conversion



Upright Ultra Low Freezers and Stability Units for the Warehouse



- Upright Ultra Low Freezers (-80°C)
 - Operate with 3.2 oz. of Ethane, R-170
 - 27.5 ft³ storage capacity
- Stability units to test packaging for products that must maintain temperature constraints during transport.
 - Operate with 5 oz Propane, R-290
 - Designed by Polar King in Fort Wayne, Indiana

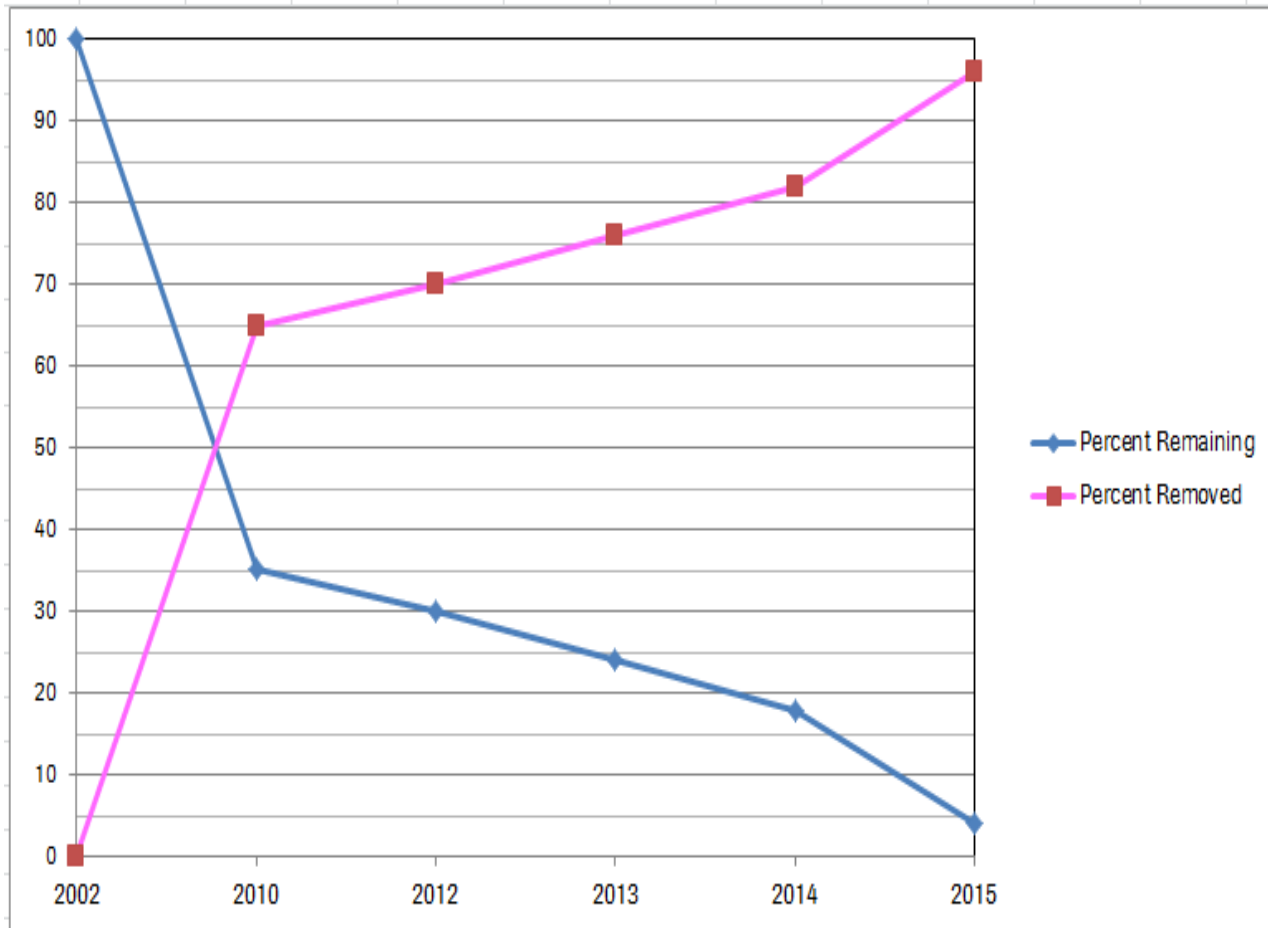
Laboratory and Social Hub Refrigerators



- HC Refrigerators used in break areas, cafeterias, and laboratories operate with hydrocarbon refrigerant (HC)
 - Propane, R-290
 - Isopentane, R-601a
 - Isobutane, R-600a



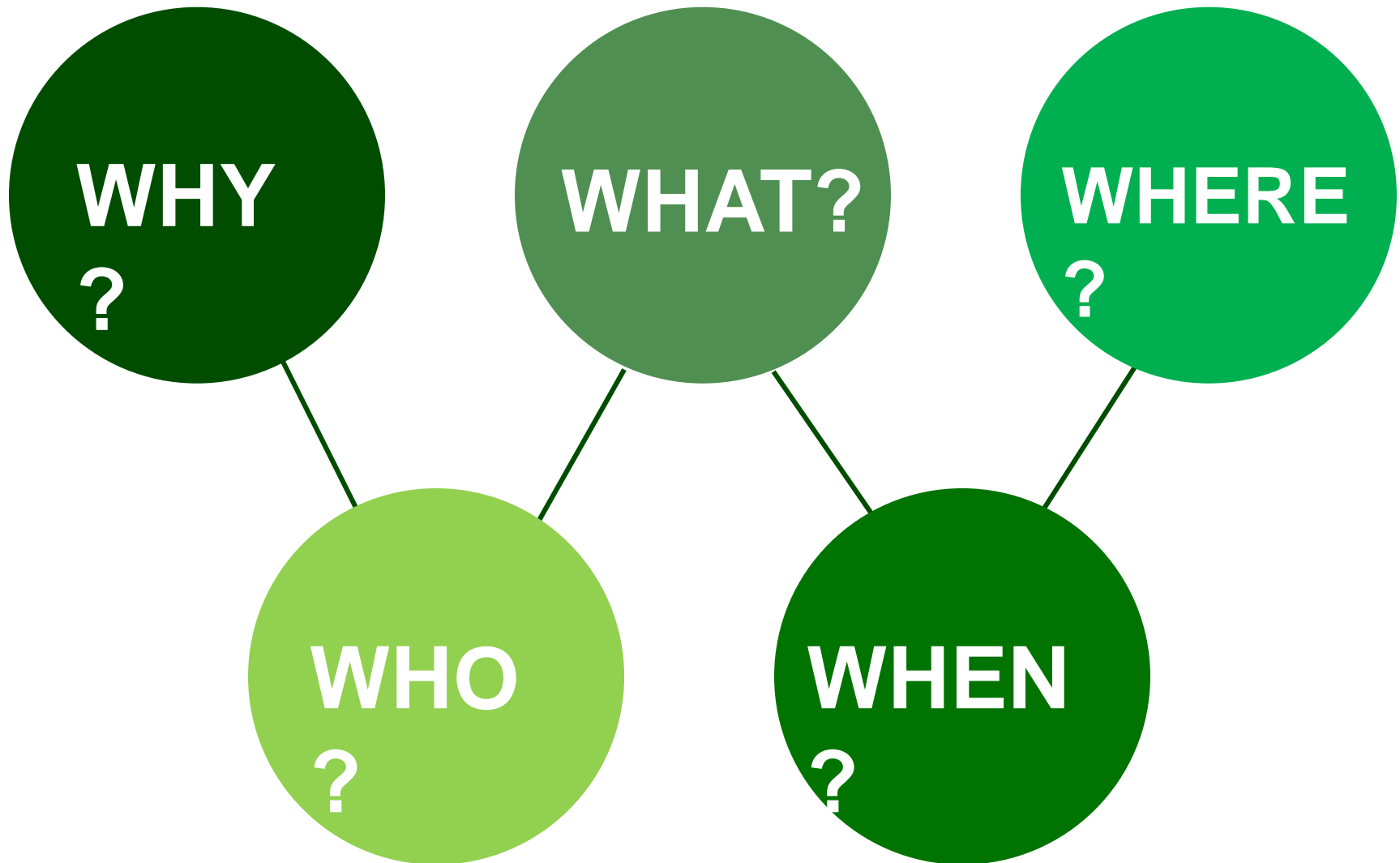
Percentage of Halogenated Hydrocarbon Refrigerants Removed and Remaining



The technology needed to meet this directive had not been developed in 2002.

Roche provided the recourses through investment and project engineers to develop solutions that meet the business needs and align with the company directive.

- The investment in natural refrigerant solutions at the Indianapolis campus was part of the \$300 million multi-year site transformation.
- The equipment developed through this initiative not only reduces the impact of substances affecting the ozone layer, but were found to be more energy efficient
- The natural refrigerant solutions custom designed by a variety of manufacturing partners are now natural refrigerant products available to the public.



Doing now what patients need next