DeCIPHER: The Saga of CFCs, Ozone Depletion, and Climate Change

This year’s DeCIPHER team examined the history of CFC decision-making through the lens of 5 key acts or ‘decision nodes’ — crucial moments in the narrative arc of risk and refrigerants that allowed project members to study competing interests of influential stakeholders or actors through background research, expert interviews, a role-playing decision theater and retrospective analysis.

**Act I: Birth of CFCs 1920s to 1950s**
- 1930: CHAPMAN MECHANISM Chapman develops theory to explain presence of ozone layer
- 1957: INT’L GEOPHYSICAL YEAR Worldwide network of ozone stations created
- 1930: CFC SYNTHESIS Midgley, Henne, & Mcary invent CFCs
- 1930: CFC BOOM CFCs enter refrigerators, air-conditioners & aerosols
- 1960s: OZONE DESTRUCTION Scientists search for destructive trace gases to explain low ozone levels
- 1978: U.S. CFC BAN U.S. bans non-essential CFC aerosol products
- 1973: CFC ACCUMULATION Lovelock detects CFC build-up in atmosphere
- 1987: “SMOKING GUN” The Airborne Antarctic Ozone Experiment confirms chlorine as ozone hole culprit
- 1984: OZONE HOLE British Antarctic Survey detects ozone hole

**Act II: Ozone Depletion 1960s to 1970s**
- 1971: UV RADIATION McDonald links ozone depletion and skin cancer in presentation to Congress
- 1974: OZONE DEPLETION THEORY Rowland & Molina publish theory of CFC-led ozone depletion
- 1985: VIENNA CONVENTION First legal framework to protect global atmosphere
- 1990: MULTILATERAL FUND MP London Amendment establishes MLF to provide financial support to developing countries
- 1991: GLOBAL OZONE REDUCTION Scientific Assessment of Ozone Depletion finds worldwide ozone depletion

**Act III: A Global Problem 1980s**
- 1987: MONTREAL PROTOCOL Int’l treaty phases down CFC production
- 1992: EARTH SUMMIT Framework Convention on Climate Change signed
- 1999: HALON-1011 Another gas added to regulated ODS list via MP Beijing Amendment

**Act IV: A Treaty Evolves 1990s**
- 1992: HCFCs & METHYL BROMIDE MP Copenhagen Amendment adds new regulated ODS
- 2000: OZONE HOLE PEAKED The Antarctic ozone hole peaks at 28.4 million km²
- 2013: HFCs & GLOBAL WARMING Fifth IPCC Report highlights HFCs

**Act V: A Climate Problem 2000s to 2010s**
- 2007: HCFC PHASE-OUT MP Adjustment speeds up HCFC phase-out due to its GWP & QOD
- 2016: HFC PHASE-DOWN MP Kigali Amendment adopts HCFC freeze and phase-out to mitigate global warming

Key to Abbreviations: MP: Montreal Protocol; MLF: Multilateral Fund; ODS: Ozone-Depleting Substance; ODP: Ozone Depletion Potential; GWP: Global Warming Potential; CFC: Chlorofluorocarbon; HCFC: Hydrochlorofluorocarbon; HFC: Hydrofluorocarbon; HFO: Hydrofluoroolefin

Key Actors: Research Government Industry Advocacy News Media

Backstage Pass:
- “Do you change your technology, your behavior, or your values when faced with risk and reward?”
  - Philip Dray, co-author of (2004)

Insights:
- Society relied on businesses’ own research of their chemical products
- Chemicals seen as immediate health risks, not as part of a complex, environmental system
- If CFC theories of ozone depletion had been disproven and costly regulation proven premature, it could have needlessly harmed the economy and the credibility of future regulation
- Scientific certainty is not a prerequisite for action; imperfect information is inherent in decision-making
- CFC regulation may look easy, but it was difficult and far from inevitable
- Sound science enables complex policymaking but does not drive it
- The MP fostered an awareness that slow-but-steady cooperation can tackle global, environmental problems
- Risk analysis alone does not convince policymakers; it’s leveraging relationships, narratives, and compromises
- Consensus is the goal, but agreement may be difficult and far from inevitable

Acknowledgements: Thank you to Bass Connections and to the experts and visitors who made this project possible

Images courtesy of: Agricultural Research Center (aerosol can), Global Warming Political Union (UV/ozone layer diagram), NASA (2006 ozone hole maximum), Global Warming Art Project (map of temperature increases)