Managers are not often confronted with problems that are independent of each other, but with dynamic situations that consist of complex systems of changing problems that interact with each other. I call such situations messes.... Managers do not solve problems, they manage messes.

- Russell Ackoff

When we think in terms of systems, we see that a fundamental misconception is embedded in the popular term "side-effects"…This phrase means roughly "effects which I hadn't foreseen or don't want to think about"…Side-effects no more deserve the adjective "side" than does the "principal" effect. It is hard to think in terms of systems, and we eagerly warp our language to protect ourselves from the necessity of doing so.

-Garrett Hardin

Complex Systems

Systems are
- Made of many interacting, interdependent parts
- Greater than the sum of parts
- Based on feedback loops and cascading causal relationships

Systems thinkers are good at
- Observing relationships
- Understanding cause and effect
- Thinking from new perspectives
- Identifying leverage points to achieve objectives

Learning Objectives

- Apply systems thinking
- EPA's Toxic Release Inventory
- Principles of industrial ecology and chemical fate
- Navigate political, social and economic complexities of pollution management
- Integrate data analysis and decision making
- Build capacity for collaboration, conflict management, negotiation, teaming

Introduction to EPA's Toxics Release Inventory

Toxic Release Inventory (TRI)
- Created in 1987
- Emergency Planning and Community Right-to-Know Act (EPCRA) § 313
- Provide the public with information about releases of toxic chemicals in their communities

Details of the TRI
- 20,000 facilities reporting
- Specific industries
- 10+ employees
- 10,000/25,000lbs chemicals
- 600+ chemicals included
- Annual reporting cycle

Geographic distribution of TRI reporting facilities (EPA, 2014).

Toxic Release!

- Teams and dossiers
- Team objectives, background and values
- Team selection
- Team member roles
- Role selection
- Decision tools
- Initial conditions
- Data tracking
- Communication with other teams
- Special action cards
- Measuring success
- Steps of play

Teams and Objectives

Industry Team
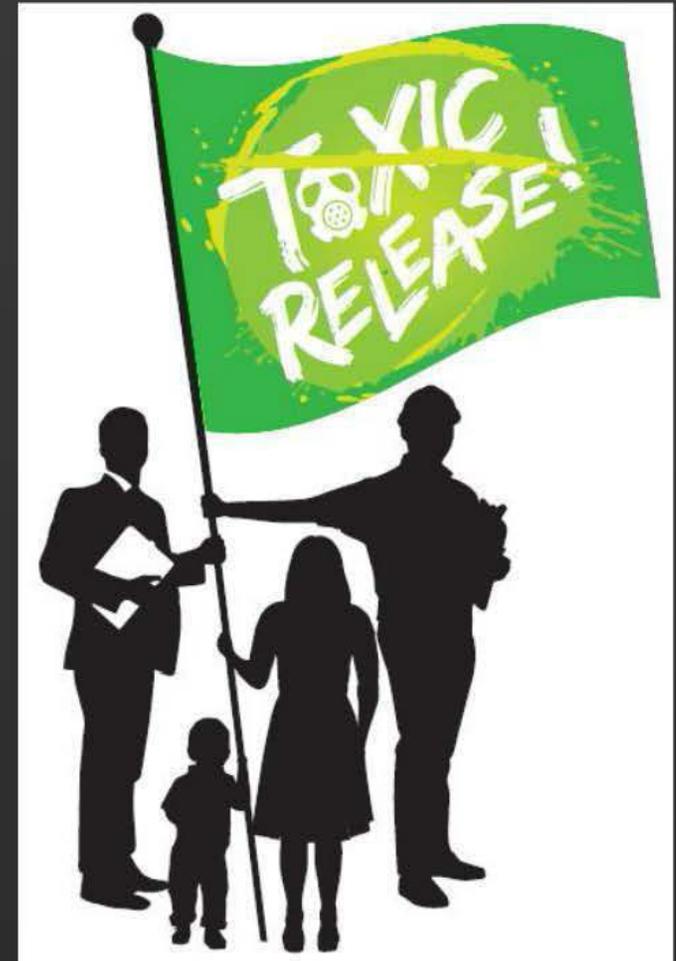- Maximize profits for shareholders

Community Advocacy Team
- Protect community members' public health
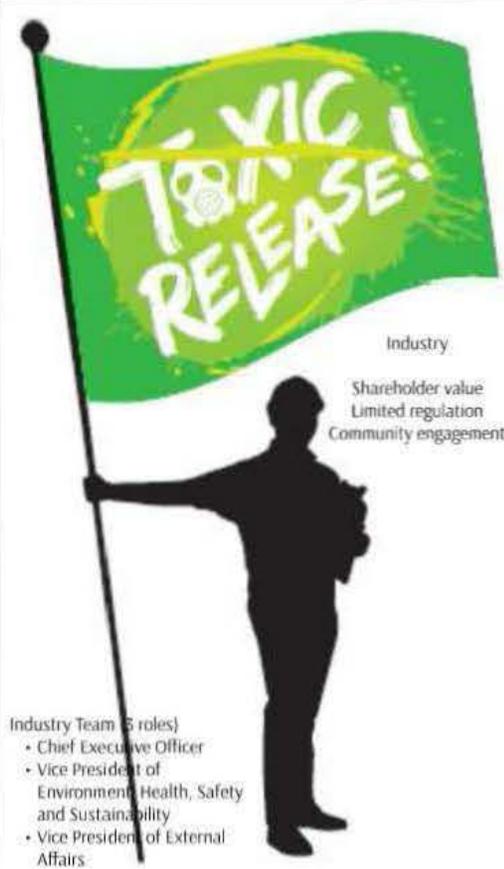- Protect local environmental resources

Government Regulator Team
- Enforce the law
- Encourage compliance with regulations
- Minimize controversy and conflict

All Teams
- Collectively reach 900 points by year 20
- Achieve a team score of 225 points by year 15
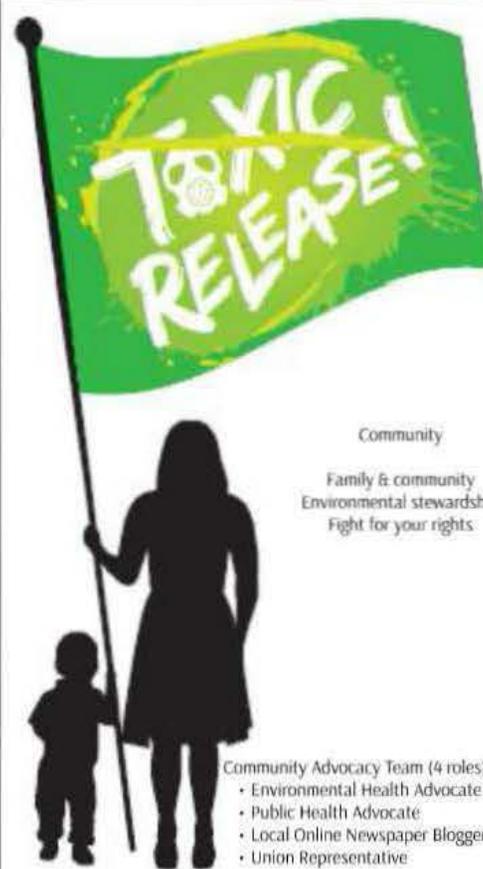
Teams, Values and Roles

Industry

Shareholder value
Limited regulation
Community engagement

Industry Team (3 roles)
- Chief Executive Officer
- Vice President of Environment Health, Safety and Sustainability
- Vice President of External Affairs

Community

Family & community
Environmental stewardship
Fight for your rights

Community Advocacy Team (4 roles)
- Environmental Health Advocate
- Public Health Advocate
- Local Online Newspaper Blogger
- Union Representative

Regulator

Equality under the law
Sustainability
Transparency & collaboration

Government Regulator Team (3 roles)
- Environmental Compliance Officer
- Public Health Officer
- Deputy Director of Policy, Toxics

Industry

Shareholder value
Limited regulation
Community engagement

Industry Team (3 roles)
- Chief Executive Officer
- Vice President of Environment, Health, Safety and Sustainability
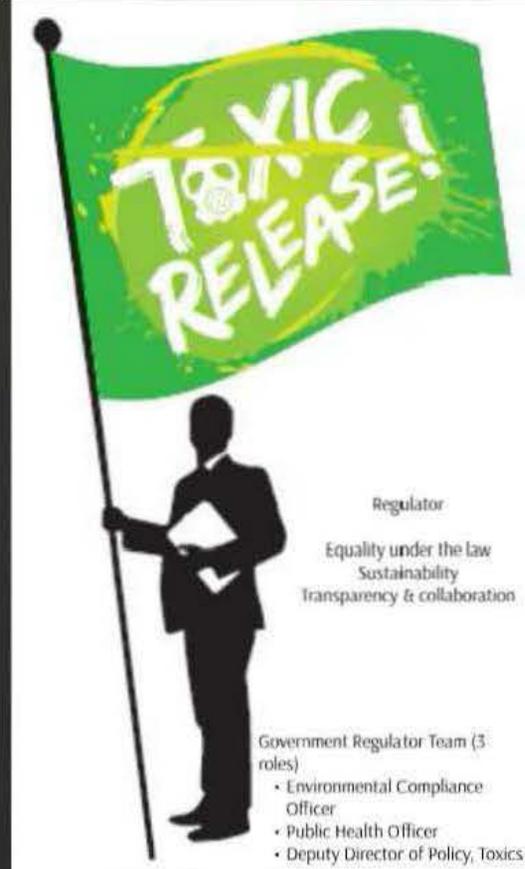- Vice President of External Affairs

Industry

Shareholder value
Limited regulation
Community engagement

Community

Family & community
Environmental stewardship
Fight for your rights

Community Advocacy Team (4 roles)
· Environmental Health Advocate
· Public Health Advocate
· Local Online Newspaper Blogger
· Union Representative

Community

Family & community
[en]vironmental stewardship
Fight for your rights

Regulator

Equality under the law
Sustainability
Transparency & collaboration

[A]dvocacy Team (4 roles)
[M]ental Health Advocate
[He]alth Advocate
[Onl]ine Newspaper Blogger
[Re]presentative

Government Regulator Team (3 roles)
• Environmental Compliance Officer
• Public Health Officer
• Deputy Director of Policy, Toxics

Select Teams

When selecting teams, you may want to consider...
- Building capacities in new skills
- Your comfort zone
- Looking at problems through a new perspective
- Putting yourself in a new pair of shoes

Team Member Roles

Industry Team		
Role	**Most Relevant Information**	**Locus of Control**
Chief Executive Officer (CEO)	Revenue, Expenses, Profit	Pace of operations (0-100); Sale Price ($10,000-$20,000)
Vice President of Environment, Health, Safety and Sustainability (VPEHSS)	Annual Chemical Releases	Pollution Prevention Technology (0-100)
VP of External Affairs (VPEA)	Community Media Viewers, Community Risk Perception	Refinery Marketing Campaign Ads (0-10)

Team Member Roles

Industry Team		
Role	**Most Relevant Information**	**Locus of Control**
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Team Member Roles

Community Advocacy Team		
Role	**Most Relevant Information**	**Locus of Control**
Public Health Advocate (PHA)	Community Members Experiencing Acute and Chronic Illness	Community Risk Perception (0-100) Freedom of Information Act Request (Pollutant data for one year) Protest!
Community Environmental Advocate (EA)	Acres of river Experiencing Eutrophication	Community Risk Perception (0-100) Freedom of Information Act Request (Pollutant data for one year) Protest!
Community Online Newspaper RS2100.com	Media Profit, Media Viewers, Industry Marketing Campaign, Community Risk Perception	
Local Union Representative (LU 401)	Profit, Acute and Chronic Illness, Local Environmental Health, Community Risk	Strike! (1=factory operational; 0=Factory shutdown)

Community Advocacy Team		
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Team Member Roles

Government Regulator Team		
Role	**Most Relevant Information**	**Locus of Control**
Public Health Officer (PHO)	Annual Chemical Releases	Warnings/Inspections (factory data for one year) Fines ($0-$300,000)
Environmental Compliance Officer (ECA)	Annual Chemical Releases	Warnings/Inspections (factory data for one year) Fines ($0-$300,000)
Deputy Director of Policy for Toxics (DDP)	Annual Chemical Releases, Pollution Prevention Technology,	Warnings/Inspections (factory data for one year)

Government Regulator Team

Role	Most Relevant Information	Locus of Control
Public Health Officer (PHO)	Annual Chemical Releases	Warnings/Inspections (factory data for one year) Fines ($0-$300,000)
Environmental Compliance Officer (ECA)	Annual Chemical Releases	Warnings/Inspections (factory data for one year) Fines ($0-$300,000)
Deputy Director of Policy for Toxics (DDP)	Annual Chemical Releases, Pollution Prevention Technology,	Warnings/Inspections (factory data for one year)

Assign Roles

When assigning roles, you may want to consider...
- Areas of expertise
- Individual interests
- Skills such as communication, persuasion, analytical thinking, problem solving

Select one team member for each duty:
- Team facilitator (manage participation)
- Reporter (oversee decision tool and filing of Special Action Cards)
- Outreach coordinator (manage interaction with other teams)
- Chief strategist (develop vision and strategy)

Decision Tools

- The decision making and feedback cycle represents one year (1 year = 1 round)
- Each team receives relevant information
- Each role responsible for recording and monitoring relevant information
- Teams are free to use any/all information to make decisions that support team objectives

Decision Tools

- Teams collectively complete Decision Dashboard
- Members contribute their individual expertise/opinions
- Track outcome data
- Use outcome data to inform decisions
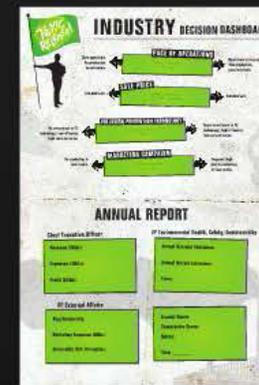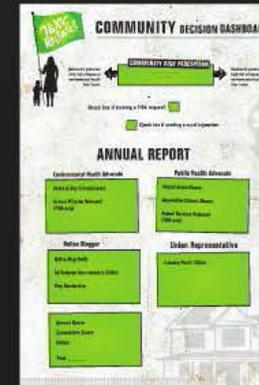
COMMUNITY DECISION DASHBOARD

TOXIC RELEASE!

COMMUNITY RISK PERCEPTION

Community perceives little risk to human or environmental health from toxics.

←→
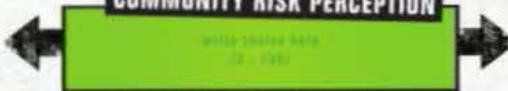
Community perceives high risk to human or environmental health from toxics.

Check box if issuing a FIOA request. ☐

☐ Check box if seeking a court injunction.

ANNUAL REPORT

Environmental Health Advocate

Acres of Bay Eutrophicated:

Annual Nitrates Released:
(FIOA only)

Public Health Advocate

Annual Acute Illness:

Cumulative Chronic Illness:

Annual Benzene Released:
(FIOA only)

Online Blogger

Online Blog Profit:

Ad Revenue from Industry (000s):

Blog Readership:

Union Representative

Industry Profit (000s):

Annual Score:

Cumulative Score:

Notes:

Year _____

INDUSTRY DECISION DASHBOARD

TOXIC RELEASE!
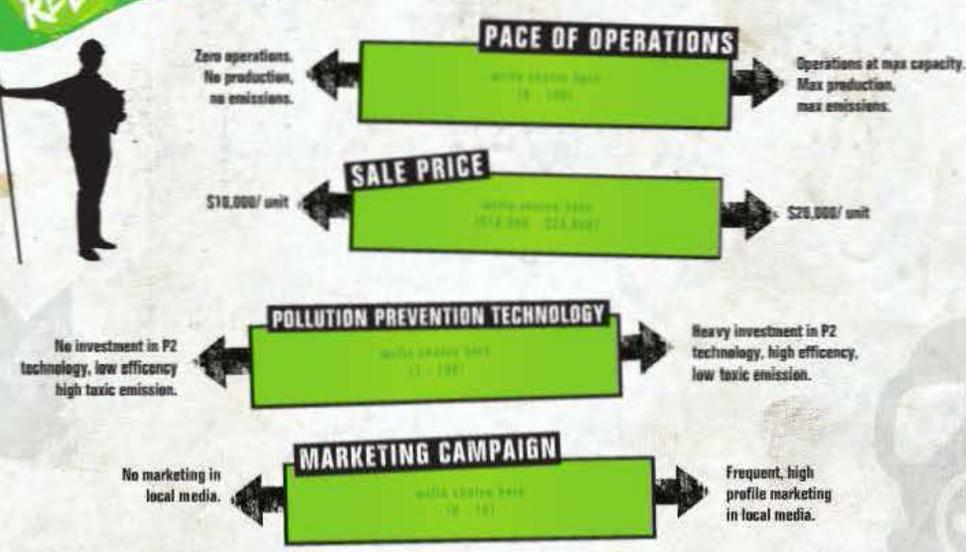
PACE OF OPERATIONS

Zero operations. No production. no emissions.

write choice here (0 - 100)

Operations at max capacity. Max production. max emissions.

SALE PRICE

$10,000/ unit

write choice here ($10,000 - $20,000)

$20,000/ unit

POLLUTION PREVENTION TECHNOLOGY

No investment in P2 technology, low efficency high toxic emission.

write choice here (1 - 100)

Heavy investment in P2 technology, high efficency, low toxic emission.

MARKETING CAMPAIGN

No marketing in local media.

write choice here (0 - 10)

Frequent, high profile marketing in local media.

ANNUAL REPORT

Chief Executive Officer

Revenue (000s):

Expenses (000s):

Profit (000s):

VP Environmental Health, Safety, Sustainability

Annual Benzene Emissions:

Annual Nitrate Emissions:

Fines:

VP External Affairs

Blog Readership:

Marketing Expenses (000s):

Community Risk Perception:

Annual Score:

Cumulative Score:

Notes:

Year _____

REGULATOR DECISION DASHBOARD

ENVIROMENTAL FINES

No Fine. ← WITH GRACE BAND IN $300,000 → $300,000 fine
Egregious violation of
Benzene Permit.

PUBLIC HEALTH FINES

No Fine. ← WITH GRACE BAND IN $300,000 → $300,000 fine
Egregious violation of
Nitrates Permit.

☐ Check this box if issuing an inspection.

Check this box if issuing an fine. ☐

ANNUAL REPORT

Environmental Compliance Officer

Annual Nitrates Emissions:

Acres of Bay Eutrophicated:

Public Health Officer

Annual Benzene Emissions:

Annual Acute Illness:

CumulativeChronic Illness:

Deputy Director of Policy

P2 Technology (Inspection only):

Industry Profit (Inspection only):

Industry Expenses (Inspection only):

Annual Score:

Cumulative Score:

Notes:

Year _____

Submitting Decisions to the Game Facilitator

- The decision making and feedback cycle represents one year (1 year = 1 round)
- Record decisions on Decision Dashboard
- Give Decision Tools to Game Facilitator
- Game Master enters decisions into computer and records outcome on Decision Dashboard
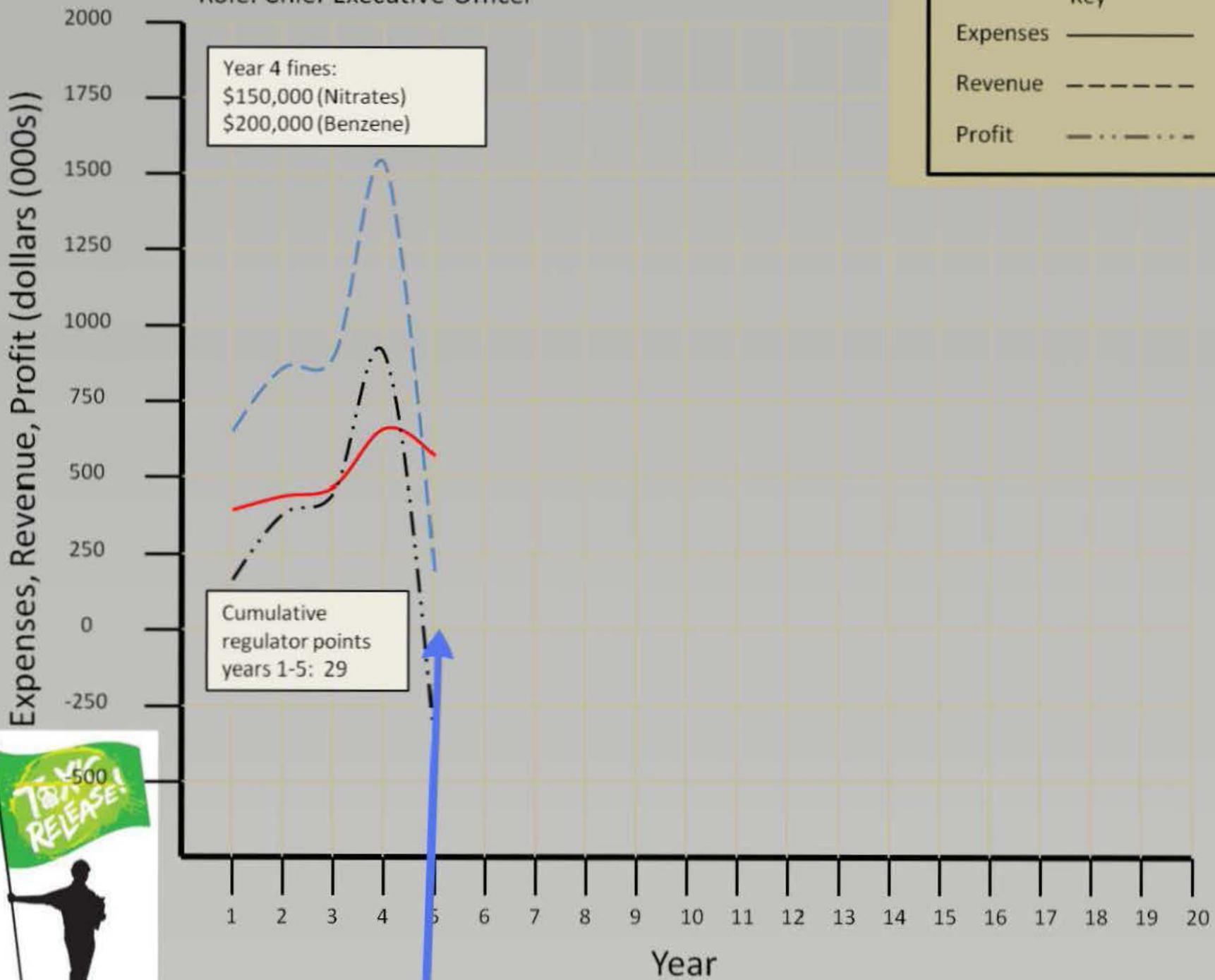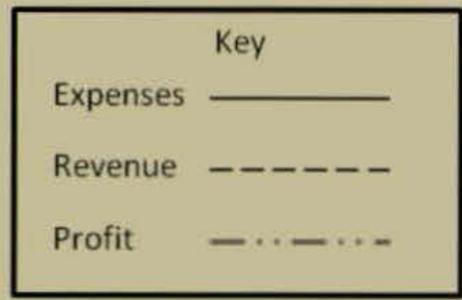- Game Master returns Decision Dashboard to teams

Data Tracking

- Each team member tracks individual data
- Use data to inform decision making
- Double-checking, aggregating or combining data is encouraged
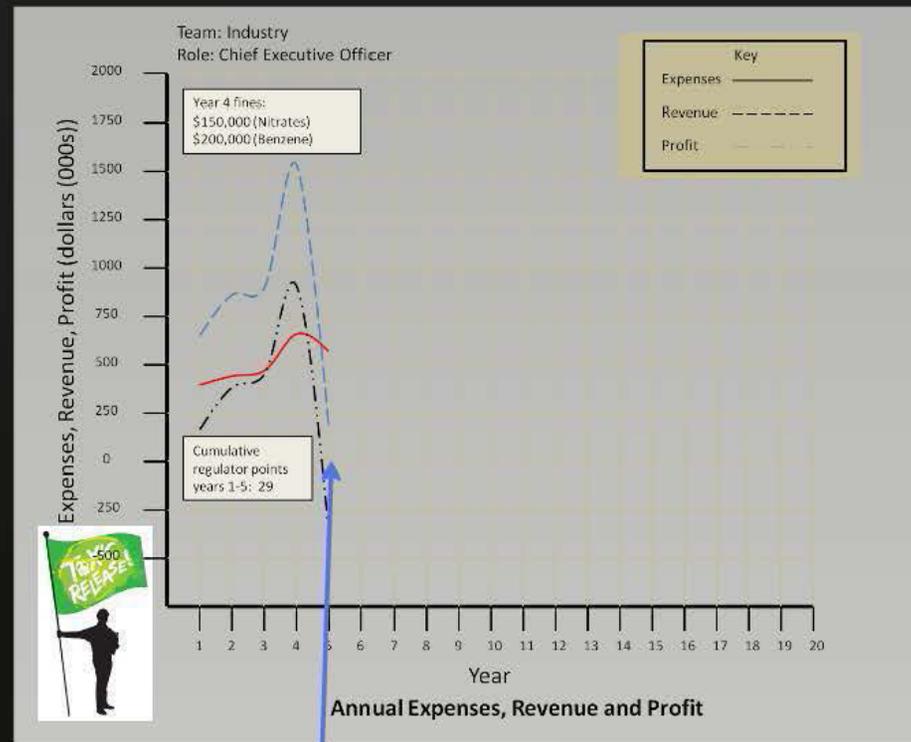
Track data starting in year 6

Annual Expenses, Revenue and Profit

Communication with other Teams

All players can interact,
communicate, collaborate, broker
agreements and negotiate freely
and at any time.

Special Action Cards

Team	Special Action Card	Issued to...	Effect
Community	Freedom of Information Act Request (FOIA)(limit: 5)	Regulators	Community team receives detailed information about industry's toxic releases and fines for one year.
	Protest & Petitions (unlimited)	Industry & Regulators	Attempt to persuade industry and regulators to be more responsive to community concerns.
	Local Union Rep 401 Court Injunction (limit: 3)	Industry	Halts factory for one year.
Regulators	Warning & Inspection (limit: 5)	Industry	Regulators receive detailed information about factory operations and P2 Technology for one year.
	Fines (limit: 5)	Industry	Penalizes industry (increases expenses) for one year.
Industry	Marketing Campaign (unlimited)	Community and Regulators	Attempt to persuade others that industry is responsive to community needs and reducing toxic releases.

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	Fines (limit: 5)	Industry	Penalizes industry (increases expenses) for one year.
Industry	Marketing Campaign (unlimited)	Community and Regulators	Attempt to persuade others that industry is responsive to community needs and reducing toxic releases.

Measuring Success

Industry Points
- Profit (max = 20pts/year)

Community Points
- Acute and Cumulative Illness, and Eutrophication (max = 20pts/year)

Regulator Points
- Average of Industry and Community Points (max = 20pts/year)
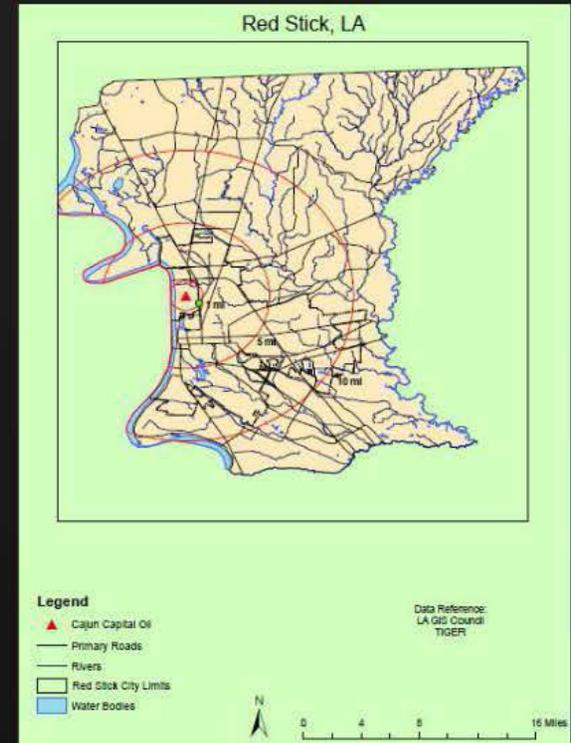
Team Objective
- Reach 300 points by year 20

Initial Game Conditions

Refinery operating at 25% capacity due to a recent malfunction. Sale prices are extremely low to encourage customers to return from downtime associated with the malfunction.

Community Risk Perception at 20%, which reflects a heightened level of risk awareness among local residents.

Regulators have performed routine inspections over the past few years. They have noted that the refinery is operating near the limits of its environmental permits, but has not exceeded them recently. The refiner is required to report to the Toxic Release Inventory.

Red Stick, LA

Legend
▲ Cajun Capital Oil
— Primary Roads
— Rivers
□ Red Stick City Limits
□ Water Bodies

Data Reference:
LA GIS Council
TIGER

N

0   4   8   16 Miles

Steps of Play

- Teams receive information
- Individual roles record/monitor information
- Teams/members discuss and interact to make decisions
- Teams record decisions and give Decision Tools to Game Facilitator
- Teams file and discuss Special Action Cards
- Game Facilitator enters decisions into computer, records on Decision Tools and returns to teams

Discuss Strategy

- Develop an initial strategy for meeting objectives
- Available resources and areas of control
- Short-term goals
- Tactics for meeting goals
- Long term vision
- Potential collaborators

Developed by:

Plattsburgh State Faculty and Students

Dr. Curt Gervich

Jake Eudene

Chris Evans

Jim Fonzone

With support from the Environmental Protection Agency and the SUNY Plattsburgh Campus Committee for Environmental Responsibility

Steps of Play

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