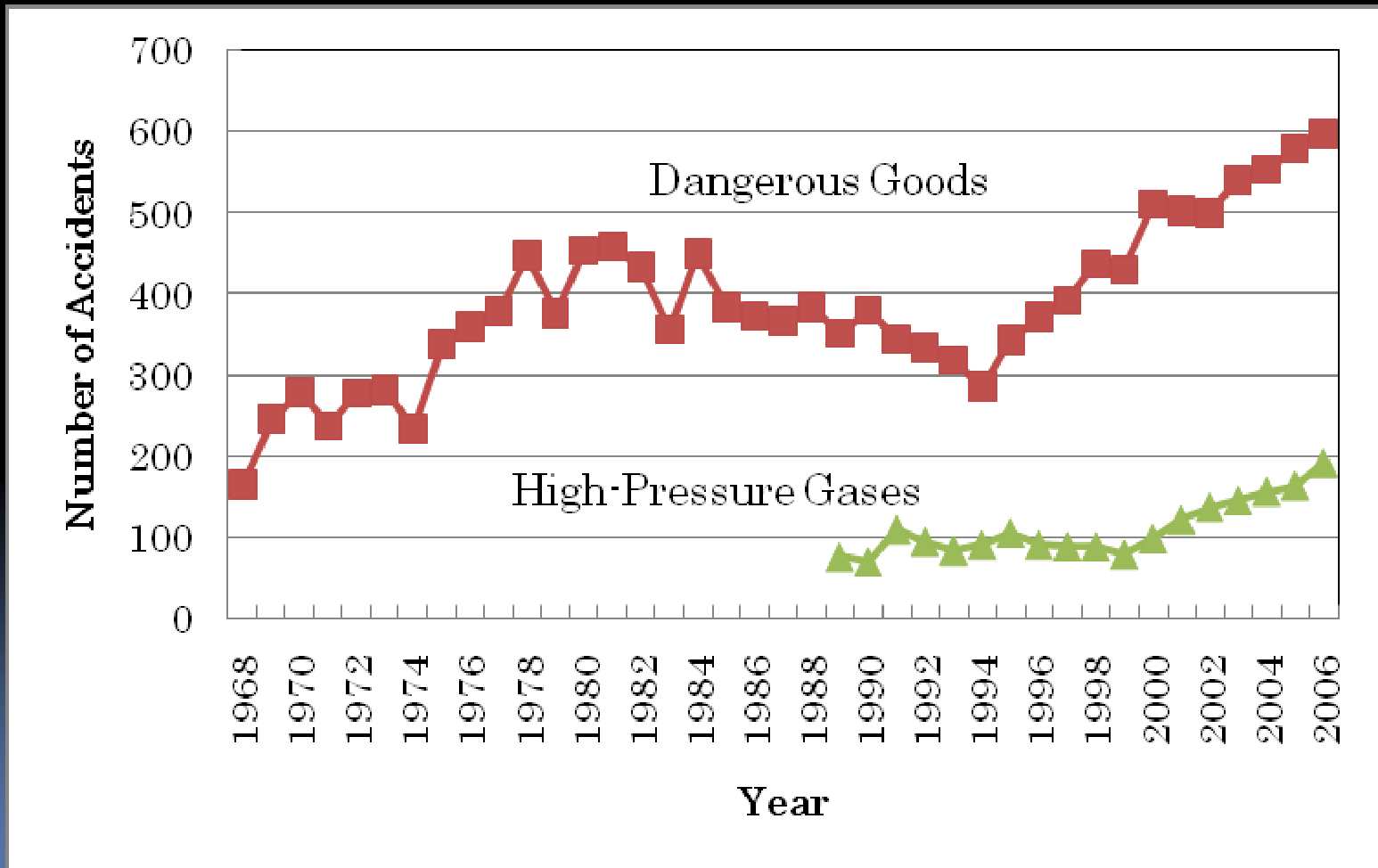




STATISTICAL ANALYSIS ON THE CAUSES OF ACCIDENTS IN JAPANESE CHEMICAL INDUSTRIES

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Figure 1: Annual Number of Accidents in Japanese Chemical Industries



Statistical Analysis

- Analyzed database

Dangerous goods accidents (1980~1999year : 7875cases)

High-pressure gases accidents (1965~2004year : 3472cases)

- Analysis method

Quantification method of the third type (developed in Japan)

- Output of the analysis

Correlation between component items

Table 1: Items in the Database for Accidents Related to Dangerous Goods

Accident Type	Facility Type	Accident Cause	Ignition Source
1. Fire	(A) Manufactory	a) Design Failure	i) Impact Spark
2. Leakage	(B) Indoor Storage	b) Application Failure	ii) Friction Heat
	(C) Outdoor Storage	c) Corrosion, Deterioration	iii) Hot Surface
	(D) Indoor Tank Storage	d) Breakage	iv) Welding Arc
	(E) Outdoor Tank Storage	e) Breakdown	v) Thermal Radiation
	(F) Underground Tank Storage	f) Maintenance Failure	vi) Electric Spark
	(G) Tank Truck	g) Disoperation	vii) Static Electricity
	(H) Gas Station	h) Unconfirmed Operation	viii) Open Flame
	(I) Movable Tank Storage	j) Inadequate Monitoring	ix) Auto-ignition
	(J) Handling Factory	k) Nonfeasance	x) Overheating
	(K) Sales Office	l) Arson	xi) Other Source
	(L) Pipeline	m) Traffic Accident	
		n) Adjacent Fire	
		o) Natural Disaster	
	p) Under Inspection, Other Cause		

Table 2: Structure of the Accident Data Base (Item Data)

Case No.	Accident Type	Facility Type	Accident Cause	Ignition Source
1	Fire	Indoor Storage	Disoperation	Hot Surface
2	Fire	Indoor Tank Storage	Application Failure	Open Flame
3	Fire	Underground Tank Storage	Corrosion, Deterioration	Static Electricity
4	Fire	Indoor Storage	Natural Disaster	Friction Heat
5	Fire	Tank Truck	Traffic Accident	Impact Spark
6	Leakage	Manufactory	Unconfirmed Operation	—
7	Leakage	Outdoor Tank Storage	Corrosion, Deterioration	—
8	Leakage	Handling Factory	Inadequate Monitoring	—
9	Leakage	Outdoor Storage	Application Failure	—
10	Leakage	Underground Tank Storage	Corrosion, Deterioration	—
⋮	⋮	⋮	⋮	⋮

Figure 2: The Quantification Method of the Third Type

	a	b	c	d
w	0	1	1	1
x	1	0	0	0
y	0	0	1	0
z	0	1	0	1



	a	d	b	c
x	1	0	0	0
z	0	1	1	0
w	0	1	1	1
y	0	0	0	1



Analysis of Dangerous Goods Accidents

Figure 3: Correlations between Accident Types, Facility Types, and Accident Causes

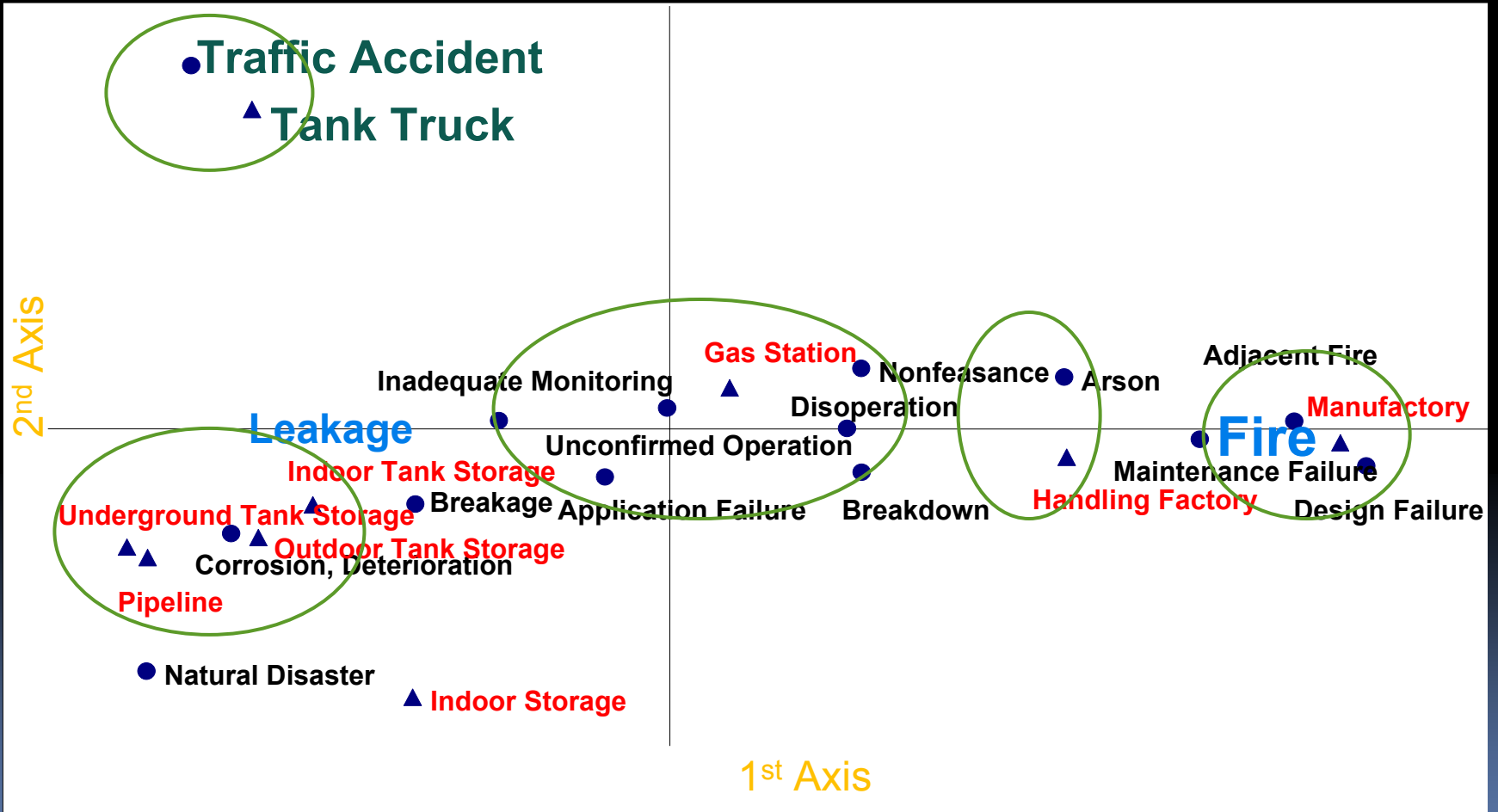


Figure 4. Correlations between Facility Types and Accident Causes for Fire Accidents

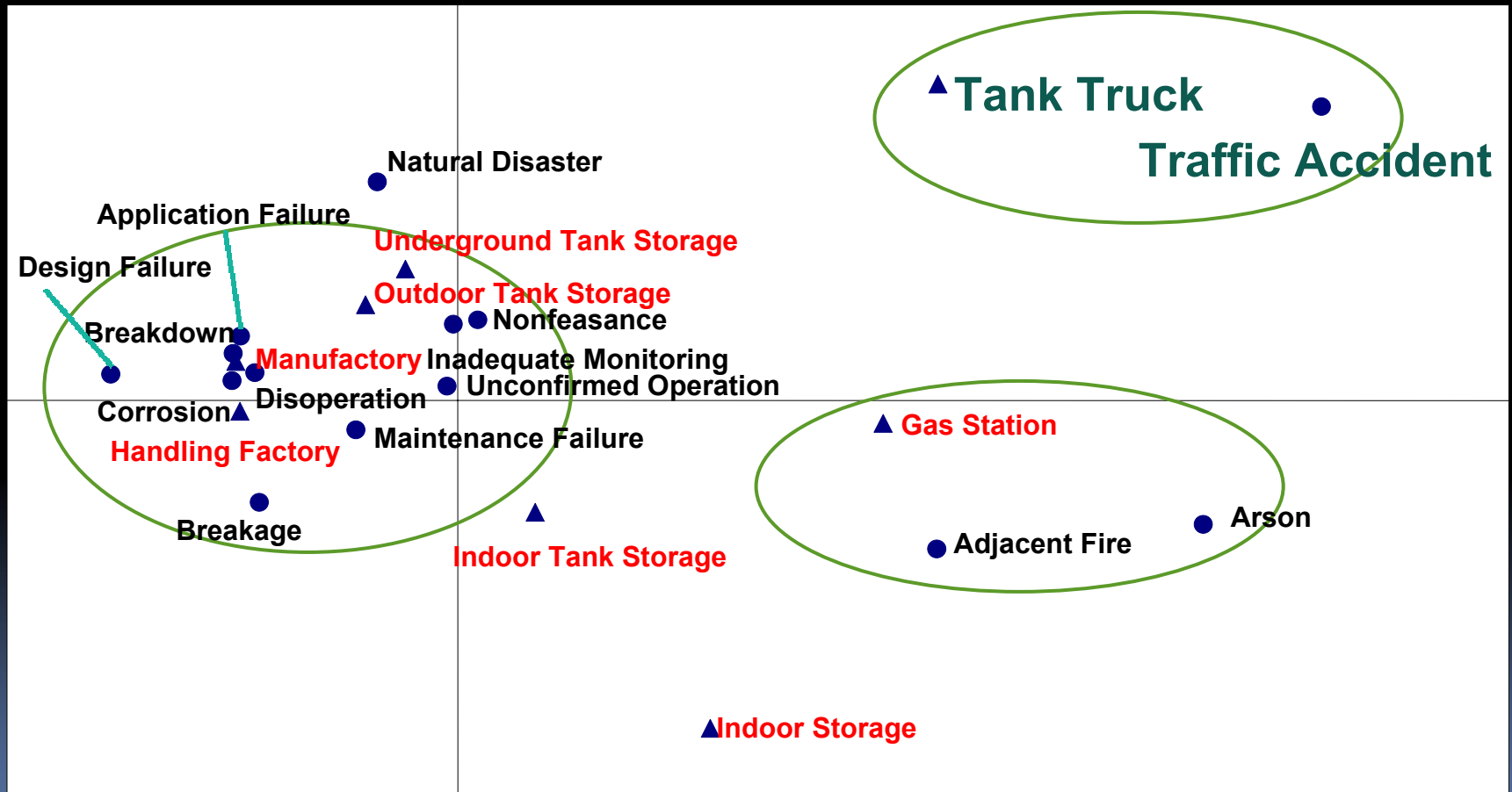


Figure 5. Correlations between Facility Types and Accident Causes for Fire Accidents (Manufactories, Handling Factories, and Gas Stations)

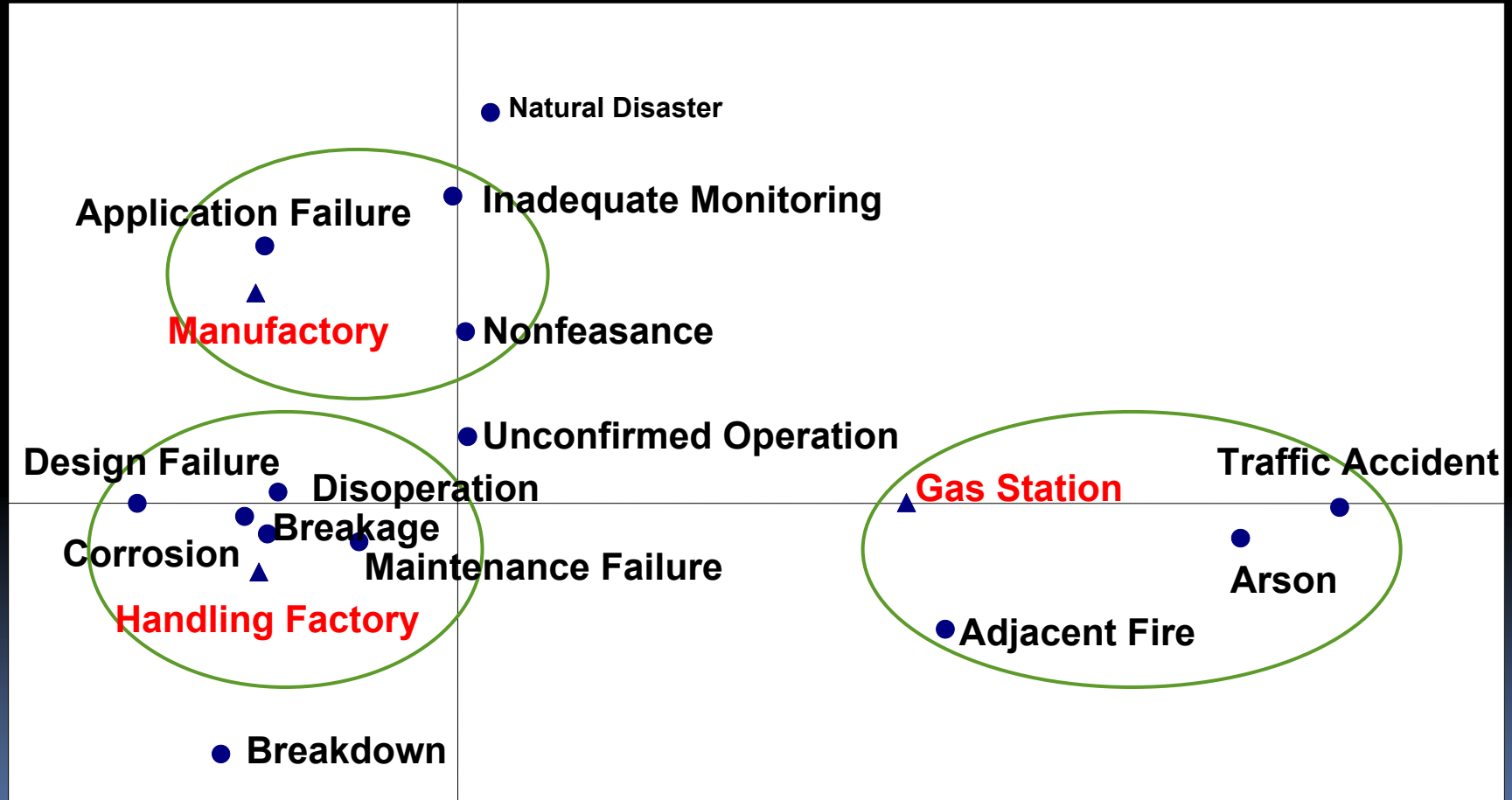


Figure 6. Correlations between Facility Types and Ignition Sources (Manufactories, Handling Factories, and Gas Stations)

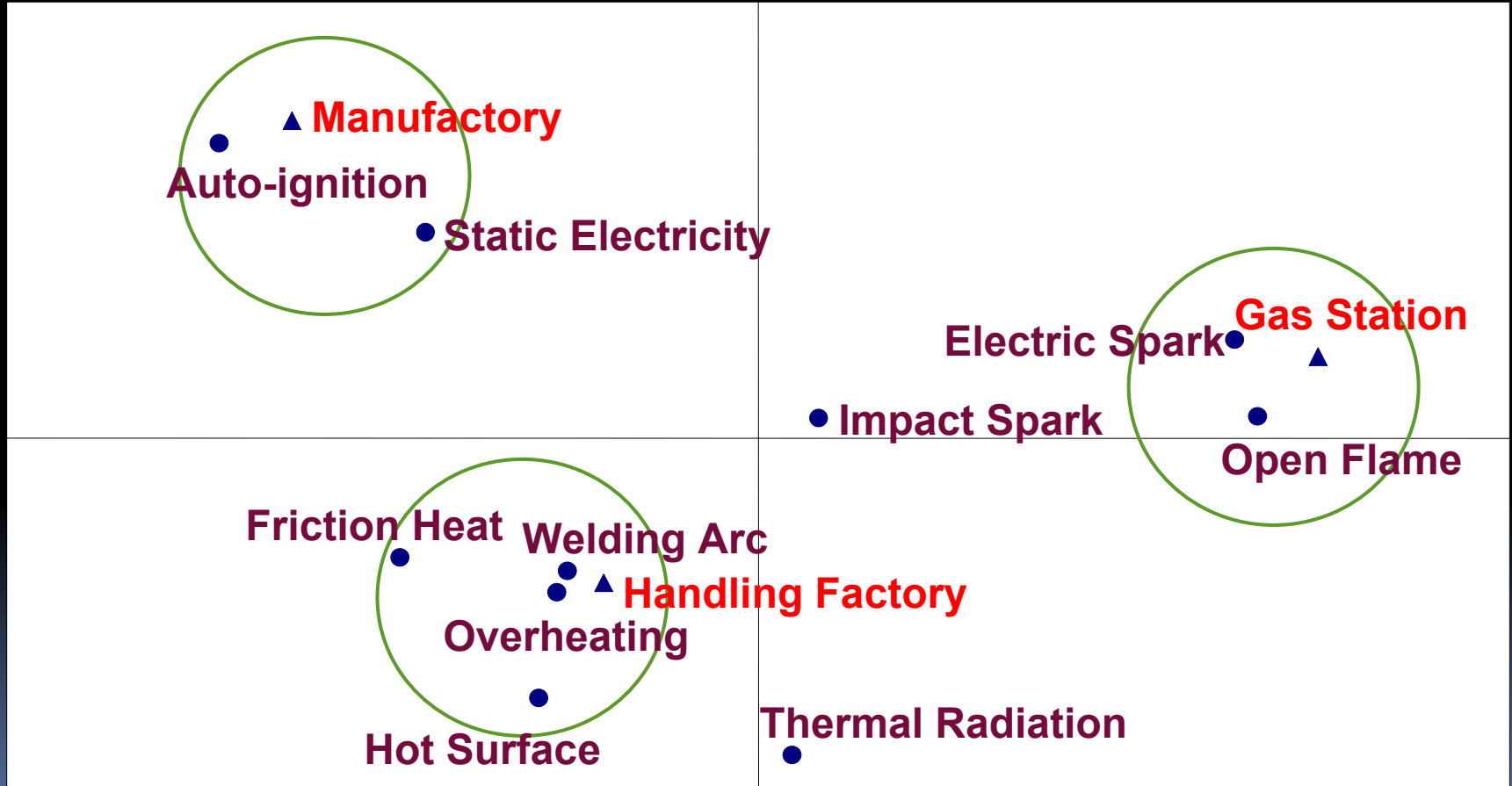
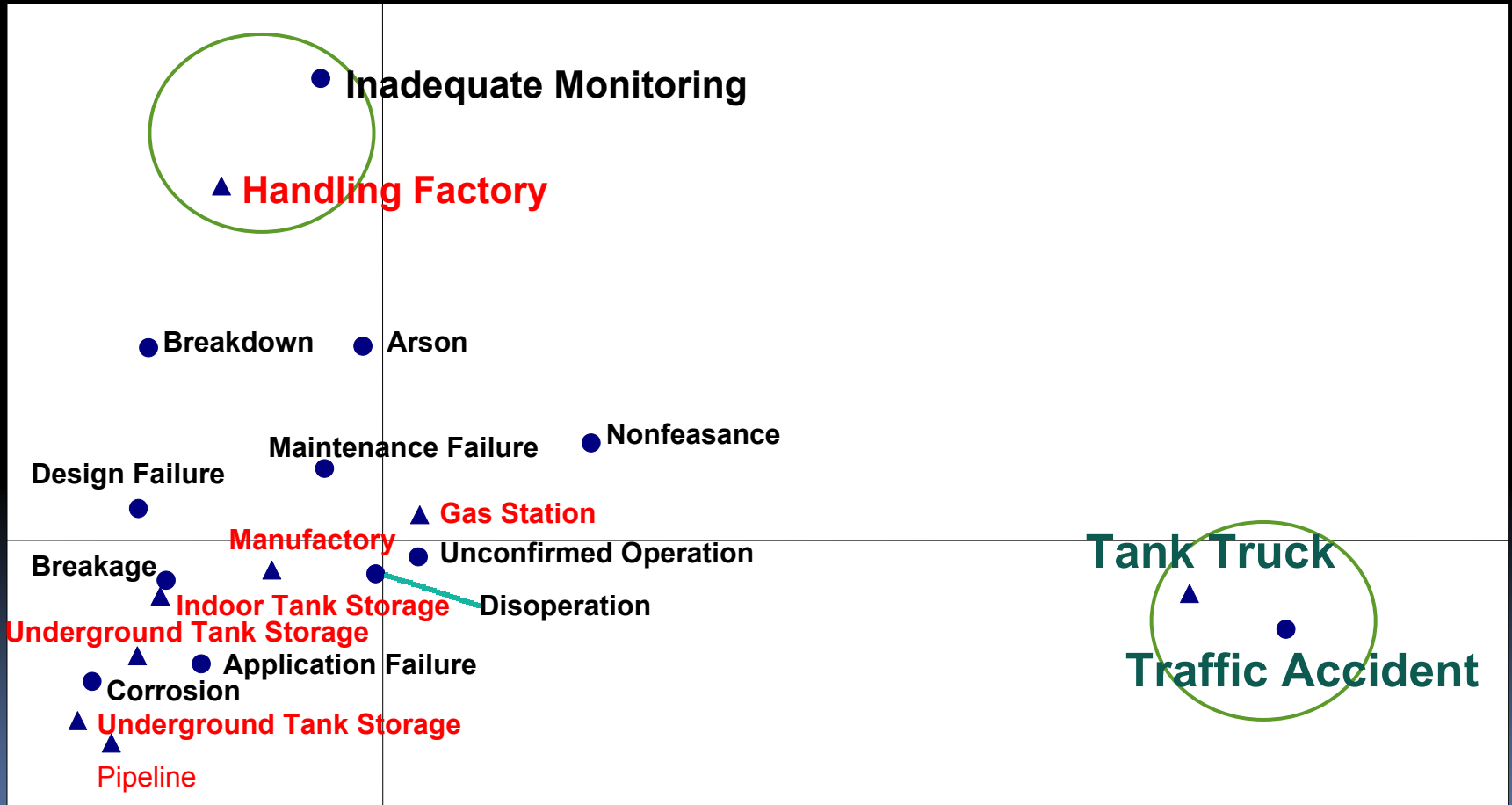


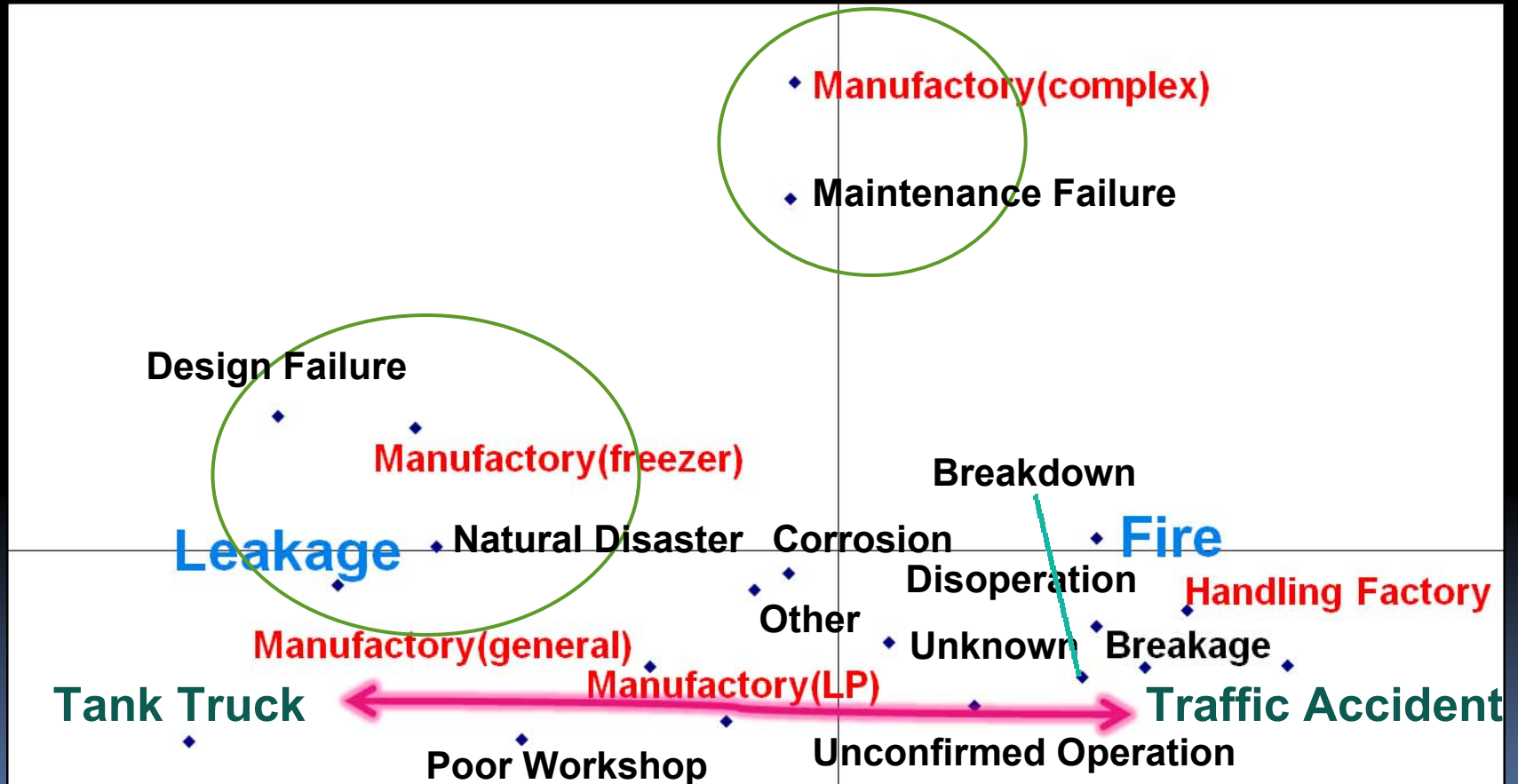
Figure 7. Correlations between Facility Types and Accident Causes for Leakage Accidents





Analysis of High-Pressure Gas Accidents

Figure 8. Correlations between Accident Types, Facility Types, and Accident Causes for High-Pressure Gas Accidents



Conclusion

Quantification analysis of the third type was conducted.

1. In the case of the dangerous goods;
 - The manufactory and the handling factory have similar accident causes.
 - Fire accidents at gas station f are strongly affected by external factors.
 - The main cause of dangerous goods tank truck is traffic accidents.
2. High-pressure gas tank truck has little relation with traffic accidents.
3. For the leakage accidents, it was not possible to clarify correlation between items.