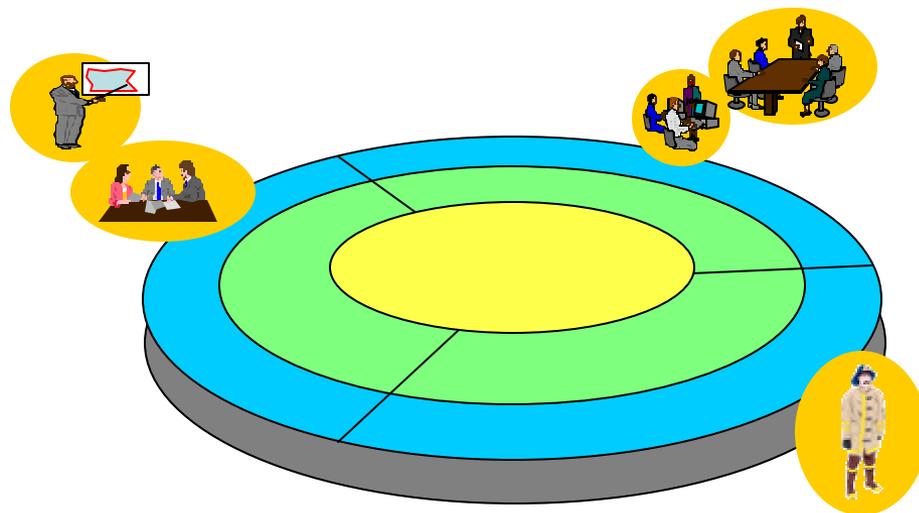


Integrated Hazard- Based Decision Making



C. Reed Hodgkin
AlphaTRAC, Inc.
May 3, 2004

Agenda

- Focus on Integrated Hazard-Based Decision Making
- Constraints on Decision Makers
- Common Problems Affect Decision Making
- Solution-A New Paradigm
- An Integrated Solution
- Example Application of Integrated Solution
- Summary

Focus on Integrated Hazard-Based Decision Making



INCIDENT COMMANDER

Decisions

- Initial Event Categorization/Classification
- Initial Protective Actions
- Initial Protective Action Recommendations



CONSEQUENCE ASSESSMENT TEAM



EMERGENCY DIRECTOR

Decisions

- Follow on Event Categorization/Classification
- Follow on Protective Actions
- Follow on Protective Action Recommendations

MANAGER OF EMERGENCY PREPAREDNESS



Decisions

- Scope of Emergency
- Offsite Planning-EPZ



HAZARD ASSESSMENT TEAM

Constraints on Decision Makers



**CONSEQUENCE
ASSESSMENT
TEAM**



**EMERGENCY
DIRECTOR**



INCIDENT COMMANDER

**MANAGER OF
EMERGENCY
PREPAREDNESS**



HAZARD ASSESSMENT TEAM

- Understanding of Hazard
- Understanding of Consequences
- Implications of Consequence Decision

- Time Constraints
- Environment for Decisions
- Available Information

Constraints on Incident Commander



INCIDENT COMMANDER

-Time: 2 minutes

-Environment

On event Scene

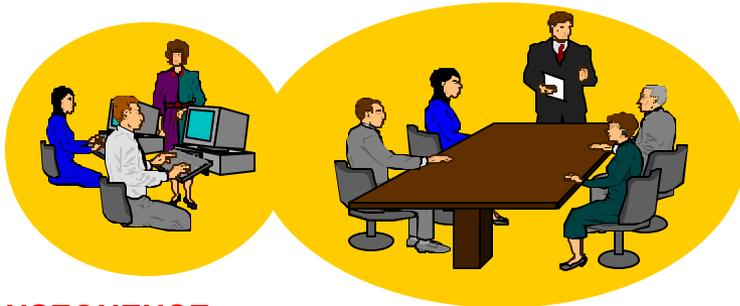
Immediate Crisis Conditions

Multiple Crisis Level Demands

-Available Information

Limited to Initial Survey

Constraints on Emergency Director



**CONSEQUENCE
ASSESSMENT
TEAM**

**EMERGENCY
DIRECTOR**

-Time: 15 minutes

-Environment

Remote from Event
Controlled

Multiple Urgent Demands

-Available Information

Limited

Evolving to Comprehensive

Constraints on Manager of Emergency Preparedness

**MANAGER OF
EMERGENCY
PREPAREDNESS**



HAZARD ASSESSMENT TEAM

- Time: Weeks to Months**
- Environment**
Planning
Preparedness
- Available Information**
Comprehensive

Common Problems Affect Decision Making

MANAGER OF
EMERGENCY
PREPARDNESS



CONSEQUENCE
ASSESSMENT
TEAM



EMERGENCY
DIRECTOR



HAZARD ASSESSMENT TEAM



INCIDENT COMMANDER



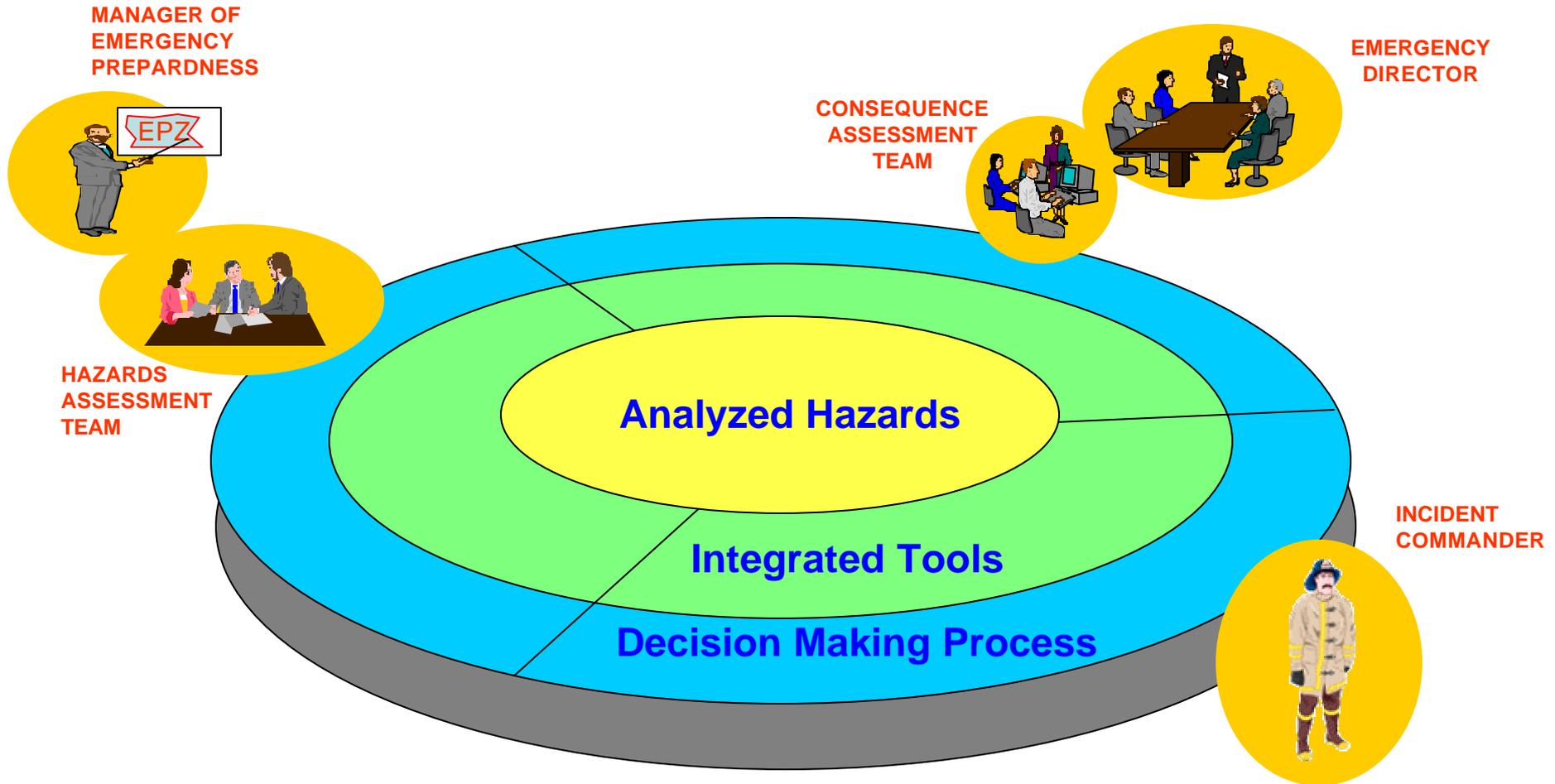
PROBLEMS IN COMMON

- Hazards and Consequences Not Comprehensively Understood
- Information Not Consist for Each Decision Maker
- Information Not Available When Needed
- Information, Process, and Tools Do Not Match Decision-Making Environment

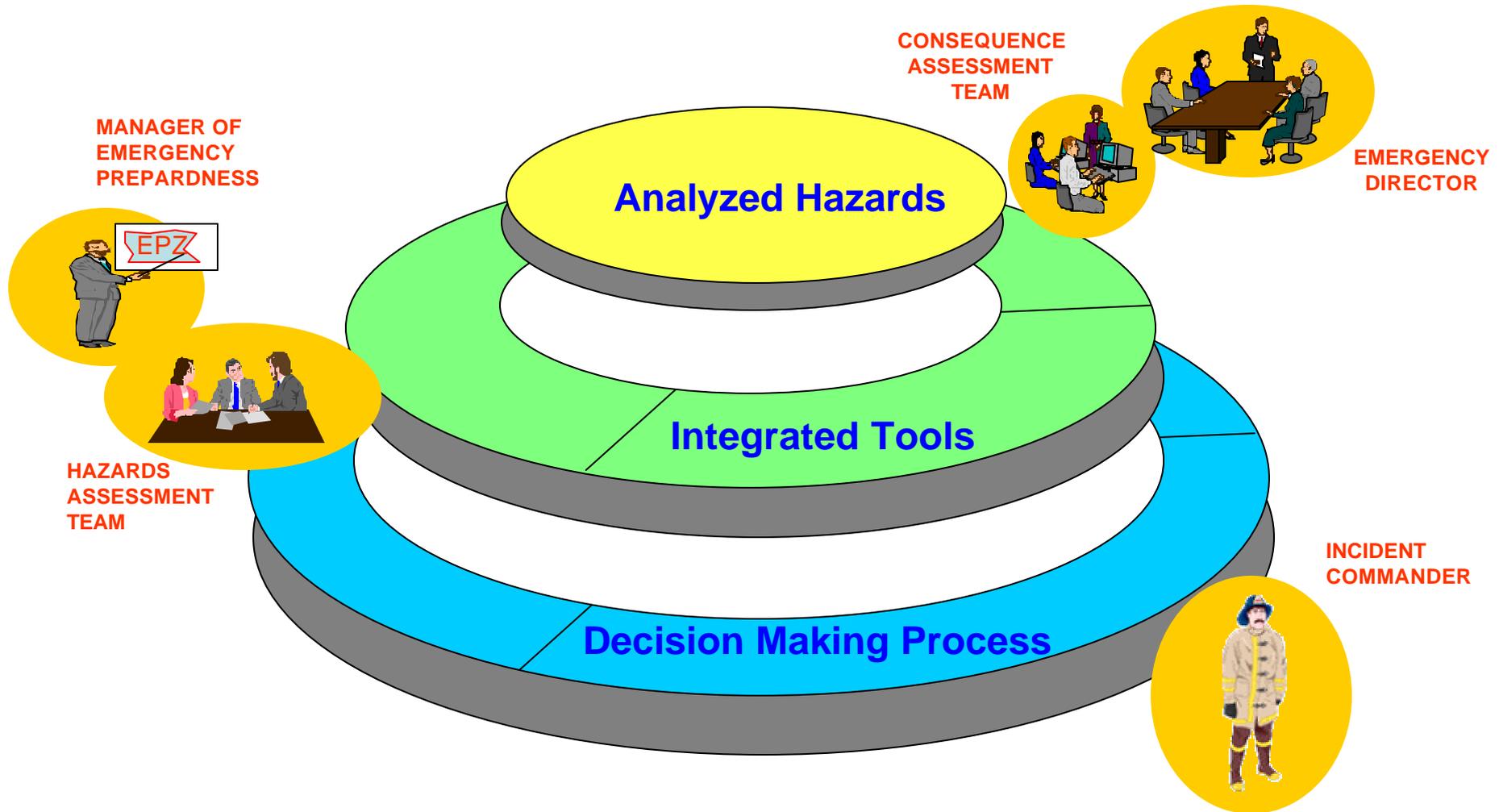
Common Solution-A New Paradigm

- Well Understood Hazards and Characteristics - Integrated Across All Applications
- Integrated Set of Tools to Meet the Individual Needs of the Decision Makers
- Integrated Decision-Making Process to Ensure Consistent, Appropriate Decisions Within Time Constraints

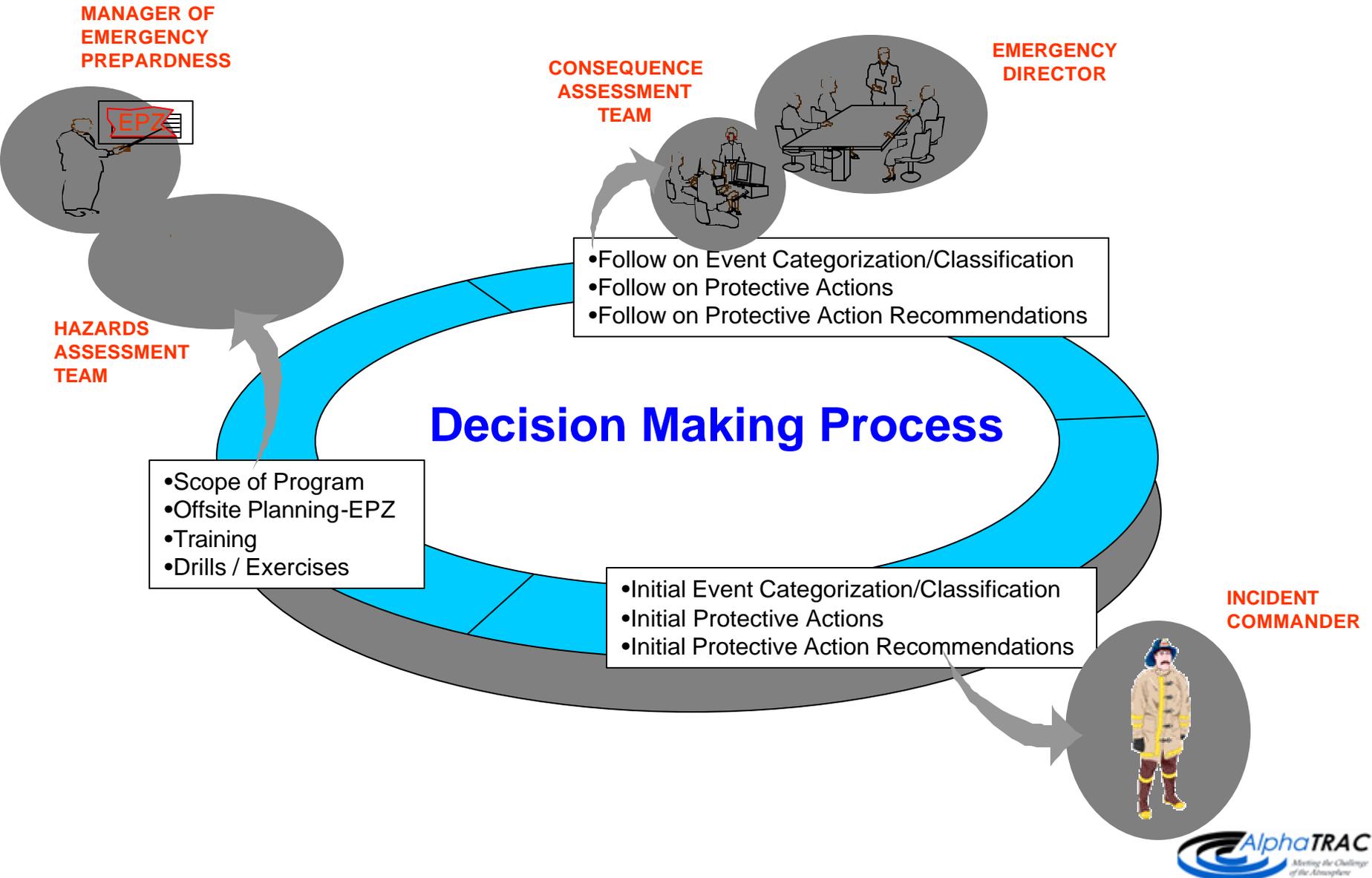
An Integrated Solution



Vertical and Horizontal Integration



An Integrated Decision Making Process



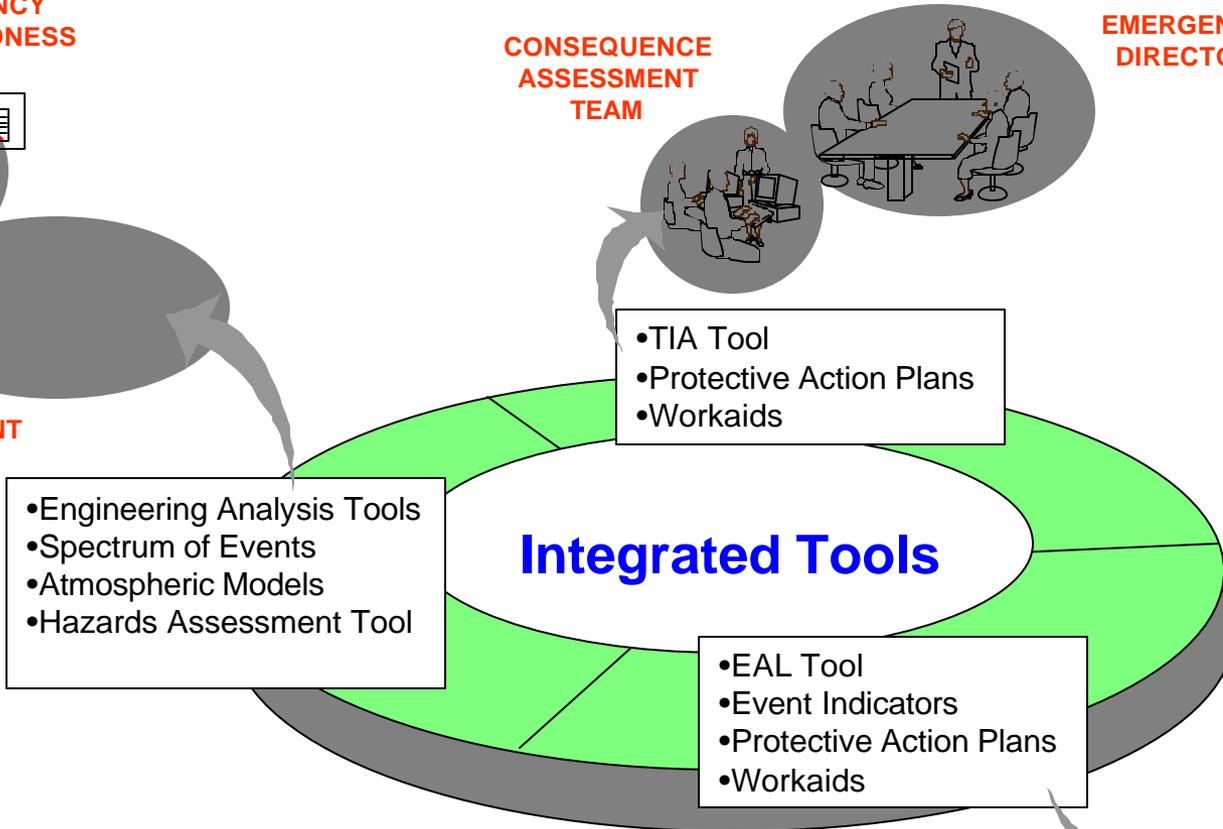
An Integrated Tool Set

MANAGER OF
EMERGENCY
PREPARDNESS

CONSEQUENCE
ASSESSMENT
TEAM

EMERGENCY
DIRECTOR

HAZARDS
ASSESSMENT
TEAM



INCIDENT
COMMANDER



The Core - A Linked Set of Analyzed hazards

MANAGER OF
EMERGENCY
PREPARDNESS

CONSEQUENCE
ASSESSMENT
TEAM

EMERGENCY
DIRECTOR

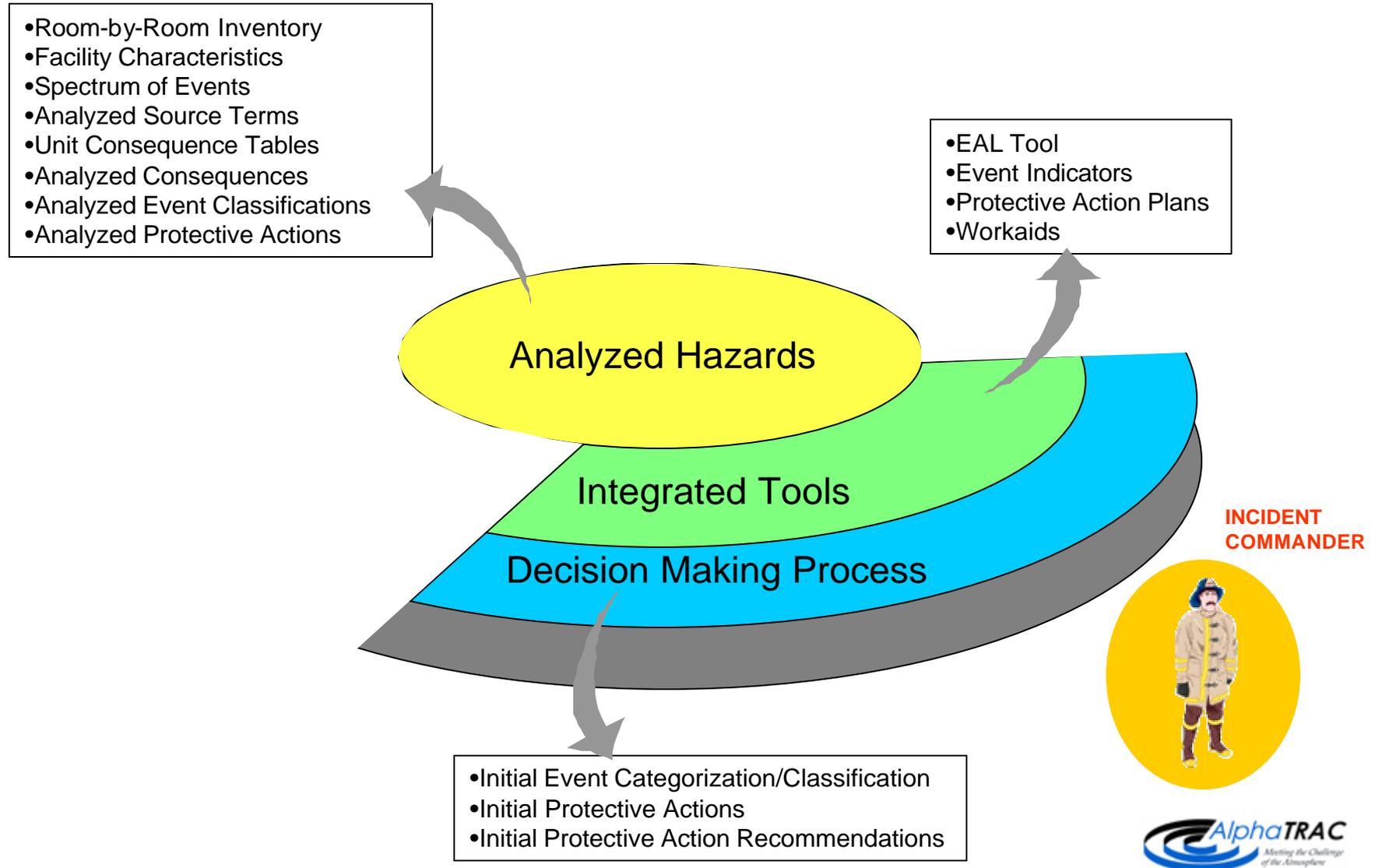
HAZARDS
ASSESSMENT
TEAM

Analyzed Hazards

INCIDENT
COMMANDER

- Room-by-Room Inventory
- Facility Characteristics
- Spectrum of Events
- Analyzed Source Terms
- Unit Consequence Tables
- Analyzed Consequences
- Analyzed Event Classifications
- Analyzed Protective Actions

Integrated for the Decision-Maker



Example Application of Integrated Solution

- Integrated Hazards Management Methodology being implemented at Sandia National Labs / NM
- Full spectrum of events analyzed room-by-room for multiple facilities - 300+ scenarios for example facility
- Automation produces much more comprehensive spectrum cost effectively
- EPZs produced and reviewed
- EAL sets are produced automatically
- Standardized Protective Action Plans accompany EALs
- Timely Initial Assessment Tool being implemented
- Decision process and procedures utilize tools

Example Consequence Table for Analyzed Hazard

Event	Release Designation	Chemical			Dispersion
		Chemical	Container type	# of containers	
Large Fire	FL-FL-MX-NAH-0247	Sodium Hydroxide (50% solution)	tote 330gal	1	TYP-D/3
Large Fire	FL-FL-MX-NAH-0248	Sodium Hydroxide (50% solution)	tank 300gal	1	TYP-D/3
Large Fire	FL-FL-MX-SAC-0249	Sulfuric Acid - 96%	tote 220gal	1	TYP-D/3
Large Fire	FL-FL-MX-SAC-0250	Sulfuric Acid - 96%	tank 300gal	1	TYP-D/3
Large Fire	MIXTURE		ALL		TYP-D/3

Event	Maximum Concentration (mg/m3)			Maximum Distance to Criteria (m)		PA Plan	Probable Emergency Class
	Facility Area	Site Area	Offsite	PAC (ERPG-2)	TEL (ERPG-3)		
Large Fire	1.72E-01	7.47E+00	6.80E+00				
Large Fire	1.57E-01	6.79E+00	6.18E+00				
Large Fire	2.65E-01	1.15E+01	1.04E+01				
Large Fire	3.60E-01	1.56E+01	1.42E+01				
Large Fire				1,849	523	4	GE

Example EAL Table

RELEASE OF GAS / PARTICULATE

Area: TECH AREA X
Facility: BUILDING AAA
Facility Zone: WGB
Site Boundary Dist (ft.): 305

EALs - PROTECTIVE ACTIONS AND EVENT CLASSIFICATION

Substance	EAL #	PROTECTIVE ACTION PLAN					EVENT CLASSIFICATION			
		Amount of Material to Trigger Plan (lbs)					Amount of Material for Class (lbs)			
		1	2	3	4	5	None	Alert	SAE	GE
UNKNOWN	AAA-WGB-1	<2	2-7	7-10	10-18	>18	<0.1	0.1-2	N/A	>2
Anhydrous Ammonia	AAA-WGB-2	<50	50-90	90-200	200-250	>250	<50	50-70	N/A	>70
Arsine	AAA-WGB-3	<5	5-10	10-18	18-25	>25	<0.2	0.2-5	N/A	>5
Phosphine	AAA-WGB-4	<2	2-7	7-10	10-18	>18	<0.1	0.1-2	N/A	>2
Silane	AAA-WGB-5	<10	10-20	20-30	30-40	>40	<6	6-10	N/A	>10

PLANNING INVENTORY FOR FACILITY ZONE

Substance	Container Type	Amt / Cont (lbs)	# of Cont	Mass in Zone (lbs)	PA Plan	Event Class	EAL #
UNKNOWN	Cylinder - 50 lb	50	1	50	5	GE	AAA-WGB-6
Anhydrous Ammonia							
	Cylinder - 50 lb	50	1	50	2	Alert	AAA-WGB-7
	Cylinder - 30 lb	30	1	30	1	None	AAA-WGB-8
	TOTAL In Zone			80			
Arsine							
	Cylinder - 40 lb	40	1	40	5	GE	AAA-WGB-9
	Cylinder - 28 lb	28	1	28	5	GE	AAA-WGB-10
	Cylinder - 5 lb	5	1	5	2	Alert	AAA-WGB-11
	TOTAL In Zone			71			
Phosphine							
	Cylinder - 28 lb	28	1	28	5	GE	AAA-WGB-12
	Cylinder - 18 lb	18	1	18	4	GE	AAA-WGB-13
	Cylinder - 5 lb	5	1	5	2	Alert	AAA-WGB-14
	TOTAL In Zone						
Silane							
	Cylinder - 7 lb	7	1	7	1	Alert	AAA-WGB-15
	TOTAL In Zone			7			

Example Protective Action Plan

EMERGENCY RESPONSE PROTECTIVE ACTION PLAN

FACILITY

PA PLAN

Building XXX

PA-3

INCIDENT COMMAND POST (check one)

- 9th Street & East Ordinance Rd.
- Wyoming Blvd. - West of 20602 Base HQ
- Eubank Blvd. & Club Road
- East of Building 905 & South of Building 919

TRAFFIC CONTROL POINTS

- | | |
|------------------------------------|--|
| 1: 9th Street & East Ordinance Rd. | 5: Club Road & 18th Ave. |
| 2: Wyoming & Harding Ave. | 6: Club Road & Eubank Blvd. |
| 3: Wyoming & G Ave. | 7: Research Rd. & Britt St. |
| 4: Club Road & 15th Ave. | 8: East of Bldg. 905
& South of Bldg. 919 |

ONSITE PROTECTIVE ACTIONS

Location	Shelter	Evacuate	Notes
Tech Area 1			
EMCORE			
Building 10500			
Base Headquarters			
Buildings 20672-20679			
Base Headquarters			
Building 20683			
Buildings 956-959			
Building 967			
Building 905			
T-33			
Buildings 853, 853B, 853C, 853D			
Building 848			
24499 AF Safety			

OFFSITE PROTECTIVE ACTIONS

NO OFFSITE PROTECTIVE ACTIONS

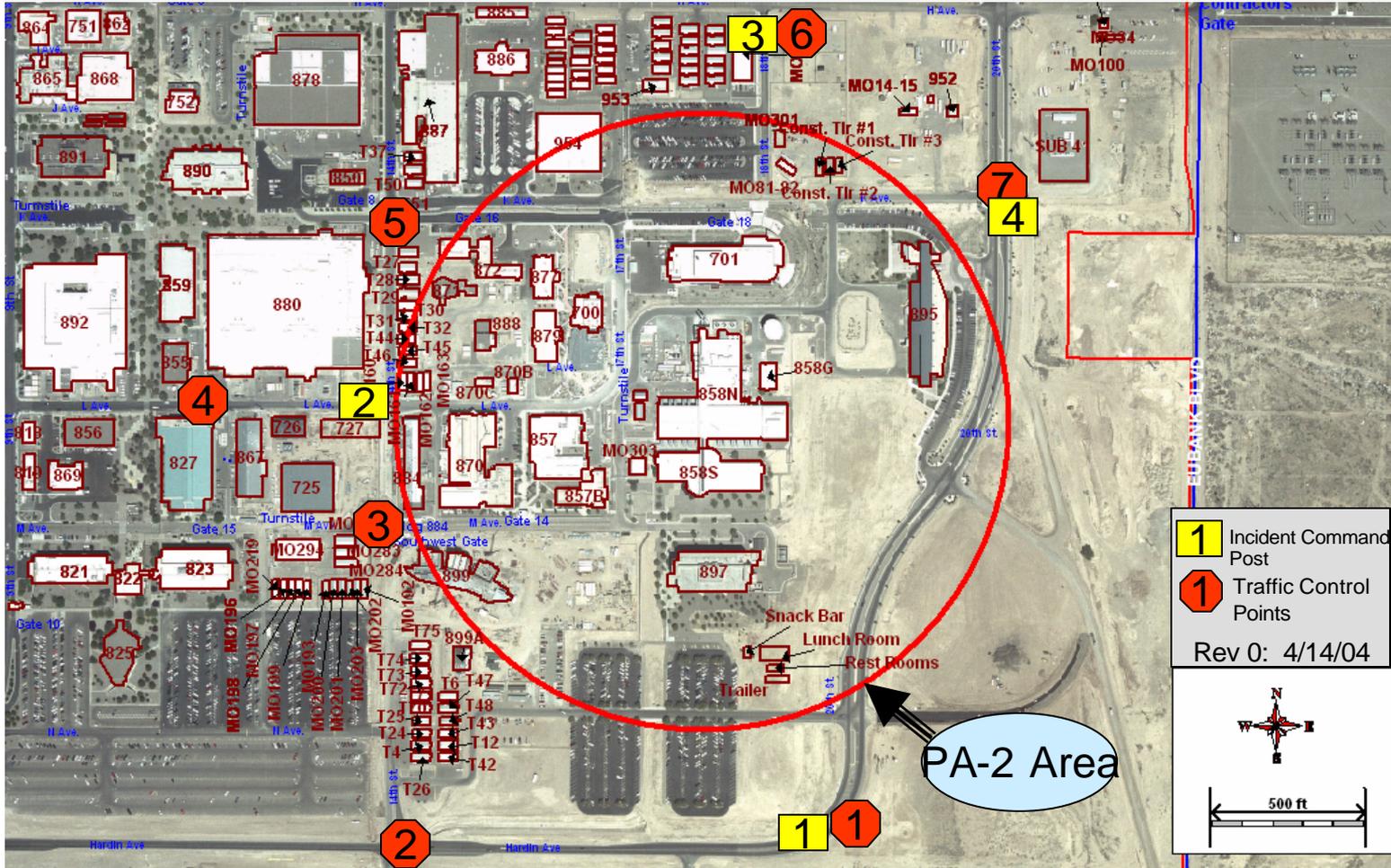
NOTES



Example Protective Action Plan Map

FACILITY: XXX

PA PLAN: 2



Example Hazard Summary from TIA Tool

HAZARDS SUMMARY

HAZARDS SUMMARY	Date 9/8/2003	Time 11:43 AM	Record ID 27
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Tech Area 1
Area

Bldg. 893
Facility

West Gas Bunker
Location

Toxic Gas Alarm 893 West Gas Bunker
Event Name

Inventory

	Hazard Name	Form	Qty	Container	Consequence	PAC	TEL	Hazard Index
1	Phosphine	Gas	1	28 lb cylinder	Concentration (mg/m3)	1	7	4.2
2	Arsine	Gas	1	40 lb cylinder	Concentration (mg/m3)	2	5	4.0
3	Arsine	Gas	1	28 lb cylinder	Concentration (mg/m3)	2	5	3.8
4	Phosphine	Gas	1	18 lb cylinder	Concentration (mg/m3)	1	7	3.7
5	Phosphine	Gas	1	5 lb cylinder	Concentration (mg/m3)	1	7	3.4
6	Phosphine	Gas	1	2.2 lb cylinder	Concentration (mg/m3)	1	7	3.1
7	Arsine	Gas	1	5 lb cylinder	Concentration (mg/m3)	2	5	3.1
8	Ammonia	Liquid	1	50 lb cylinder	Concentration (mg/m3)	140	700	2.1
9	Silane	Gas	1	7 lb cylinder	Concentration (mg/m3)	33	5240	1.9
10								
11								
12								
13								
14								
15								

Summary

- Effective decision making is the focus
- Decision-makers share common problems
- Solution is an integrated system of decision processes and tools linked to common database of analyzed hazards
- Field implementation shows that it works!

