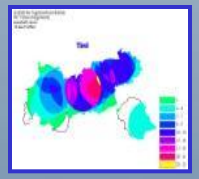
Environmental Management System Using GIS at UPR Río Piedras Campus



Presented by: Johnny Lugo Vega, (OPASO), UPR RP
and
Jorge L. Nina Espinosa, Environmental Health Department
UPR RCM

Agenda

- Introduction to EMS/GIS
  - Objectives
  - Purpose
  - Components
- UPREMIS Outlook
  - Academic Component Architecture
  - Operational Component Architecture
    - ✓ Phase I: Chemical Inventory Control and Base Data System Management
    - ✓ Phase II: Pilot Laboratory: GIS Approach (Simulation)
    - ✓ Phase III: Risk Assessment and Risk Profile
  - RP Communities Emergency Communication System
  - Emergency scenario (Simulation)
- Summary
- References
- Acknowledgements

Introduction EMS

- EMS
- Follows AM/FM industrial management systems
- Also, USEPA HZW reduction guidelines
- Information system and procedures standardization
- Report process (audits)
- Based on P2 and Sustainability
- EMIS:
  - With Geographical Information Systems incorporation
  - Scale modification to Risk Assessment and new perspective for planning
- UPREMIS is based but not limited to three single components:
  - Operational, Academic and Community

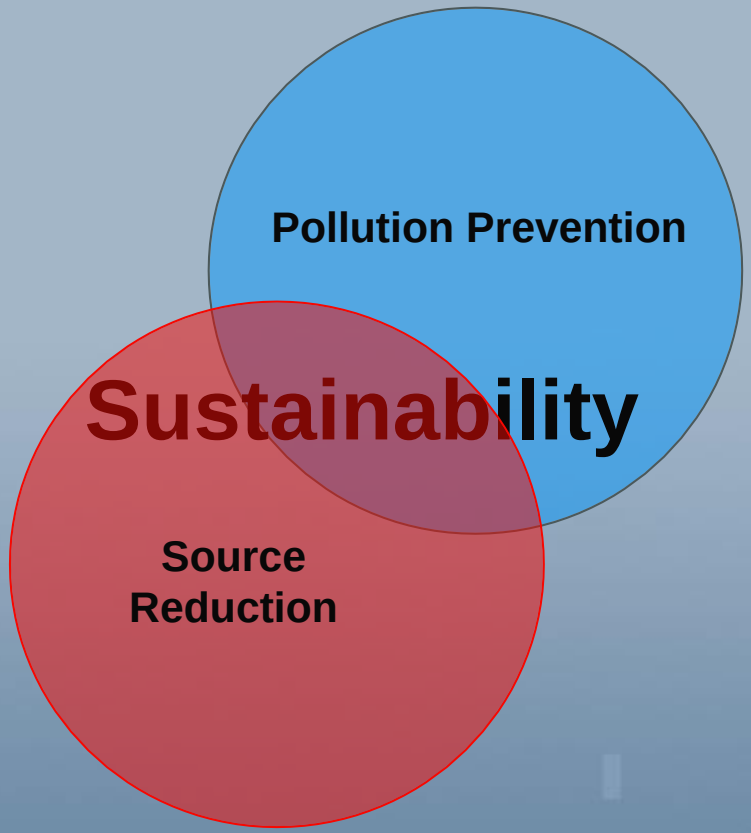
Objectives

- Integrate prevention and sustainable strategies within an environmental structure
- Improve occupational safety and environmental standards compliance (ISO14000)
- Designs an micro-architecture as a model of source reduction under a sustainable perspective
- Temperate project for real issues such as PR's solid waste problems.

Purpose

- Integration of different fundamental components into a holistic environmental structure developed in a sustainable perspective

Holistic Approach



USEPA Vision (Compatibility with UPREMIS)

- **There will be a need for more sustainable use of resources.** Most people believe that the current trend is toward greater demands on, and consumption of, material resources in this country and elsewhere. While the economic value of some of these resources might increase, the more important (but often hidden) price to be paid may well be an environmental one. Extracting, producing, and using ever-increasing volumes of material resources—most of which are finite—will inevitably have important environmental consequences. Some recent studies have projected that the current global economy cannot be sustained over the long term without severe environmental consequences. The challenge at hand, therefore, is to create a system that enables economic prosperity to co-exist with a healthy global environment, by using less and making more efficient use of the material resources that are consumed.

Source: http://www.epa.gov/epaoswer/osw/vision.pdf

Compliance Approach

U.S. Environmental Protection Agency

Pollution Prevention (P2)

Recent Additions | Contact Us Search: All EPA This Area Go

You are here: EPA Home » Prevention, Pesticides & Toxic Substances » Pollution Prevention & Toxics » Pollution Prevention » Basic Information » Pollution Prevention Act of 1990

- Pollution Prevention Home
- Basic Information
- Where You Live
- Grants & Funding
- Laws and Policy
- Partnerships
- Technical Assistance
- Tools
- Publications

Pollution Prevention Act of 1990

UNITED STATES CODE TITLE 42
THE PUBLIC HEALTH AND WELFARE
CHAPTER 133

POLLUTION PREVENTION

§ 13101. Findings and policy
§ 13102. Definitions
§ 13103. EPA activities
§ 13104. Grants to States for State technical assistance programs
§ 13105. Source Reduction Clearinghouse
§ 13106. Source reduction and recycling data collection
§ 13107. EPA report
§ 13108. Savings provisions
§ 13109. Authorization of appropriations

Source: http://www.epa.gov/p2/

Green Chemistry Approach

U.S. Environmental Protection Agency

Green Chemistry

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EPA Home > Prevention, Pesticides & Toxic Substances > Pollution Prevention and Toxics > Green Chemistry

United States Environmental Protection Agency

- Green Chemistry Home
- Basic Information
- EPA Projects & Programs
- Grants & Fellowships
- International Activities
- Tools & Literature
- Documents
- Site Map

Presidential GC Challenge
- Winners by Year
- Winners by Topic
- How to enter

Documents

Related Links

Highlights

2006 Winners

2006 Summary Document

Green Chemistry Mission

To promote innovative chemical technologies that reduce or eliminate the use or generation of hazardous substances in the design, manufacture, and use of chemical products.

GREEN CHEMISTRY

Source: http://www.epa.gov/oppt/greenchemistry/

Prevention Source Reduction Approach

U.S. Environmental Protection Agency

Green Chemistry

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EPA Home > Prevention, Pesticides & Toxic Substances > Pollution Prevention and Toxics > Green Chemistry > Principles

- Green Chemistry Home
- Basic Information
- EPA Projects & Programs
- Grants & Fellowships
- International Activities
- Tools & Literature
- Documents
- Site Map

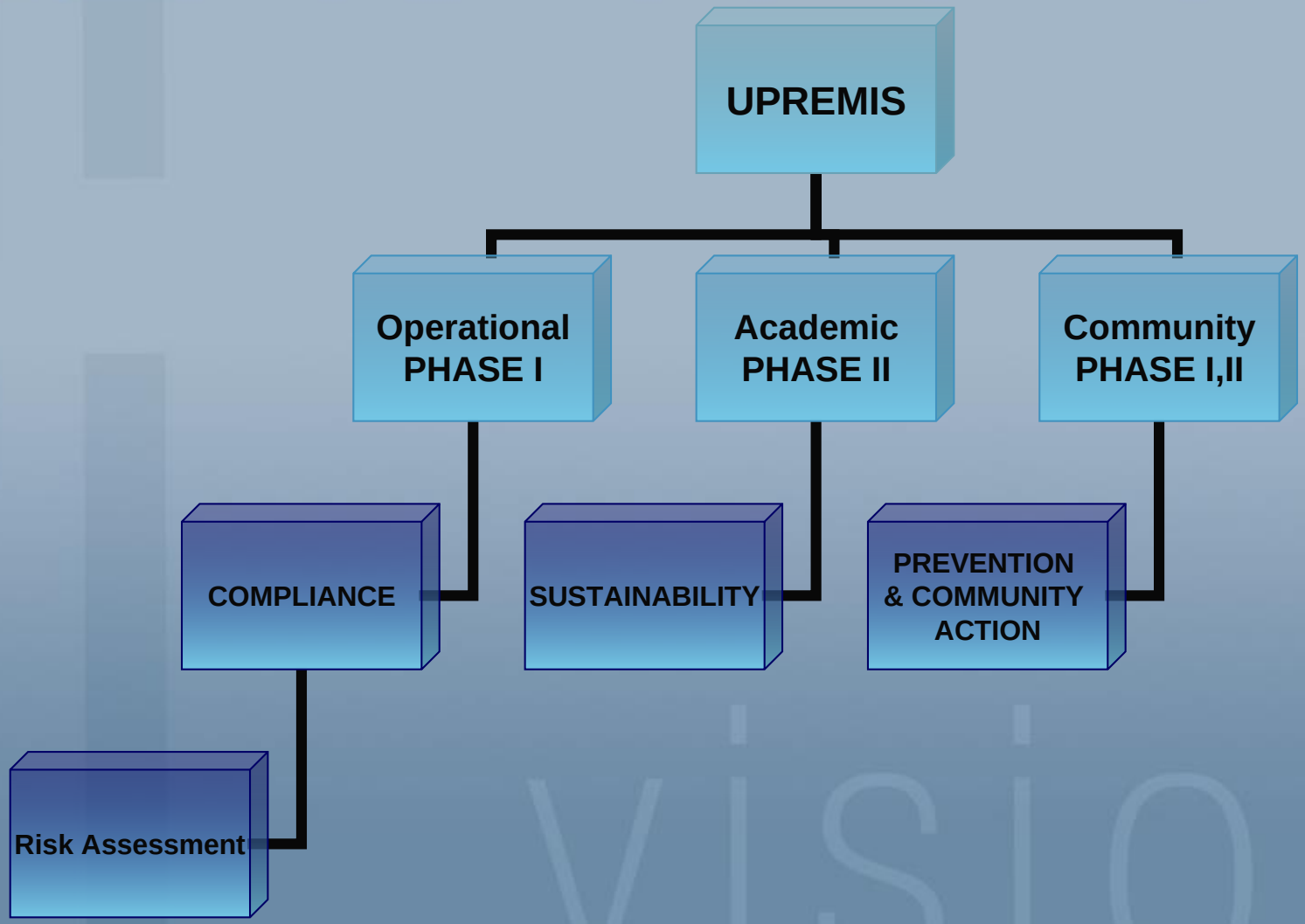
12 Principles of Green Chemistry

GREEN CHEMISTRY

1. **Prevent waste:** Design chemical syntheses to prevent waste, leaving no waste to treat or clean up.
2. **Design safer chemicals and products:** Design chemical products to be fully effective, yet have little or no toxicity.
3. **Design less hazardous chemical syntheses:** Design syntheses to use and generate substances with little or no toxicity to humans and the environment.
4. **Use renewable feedstocks:** Use raw materials and feedstocks that are renewable rather than depleting. Renewable feedstocks are often made from agricultural products or are the wastes of other processes; depleting feedstocks are made from fossil fuels (petroleum, natural gas, or coal) or are mined.
5. **Use catalysts, not stoichiometric reagents:** Minimize waste by using catalytic reactions. Catalysts are used in small amounts and can carry out a single reaction many times. They are preferable to stoichiometric reagents, which are used in excess and work only once.
6. **Avoid chemical derivatives:** Avoid using blocking or protecting groups or any temporary modifications if possible. Derivatives use additional reagents and generate waste.
7. **Maximize atom economy:** Design syntheses so that the final product contains the maximum proportion of the starting materials. There should be few, if any, wasted atoms.
8. **Use safer solvents and reaction conditions:** Avoid using solvents, separation agents, or other auxiliary chemicals. If these chemicals are necessary, use innocuous chemicals.
9. **Increase energy efficiency:** Run chemical reactions at ambient temperature and pressure whenever possible.
10. **Design chemicals and products to degrade after use:** Design chemical products to break down to innocuous substances after use so that they do not accumulate in the environment.
11. **Analyze in real time to prevent pollution:** Include in-process real-time monitoring and control during syntheses to minimize or eliminate the formation of byproducts.
12. **Minimize the potential for accidents:** Design chemicals and their forms (solid, liquid, or gas) to minimize the potential for chemical accidents including explosions, fires, and releases to the environment.

Source: http://www.epa.gov/oppt/greenchemistry/

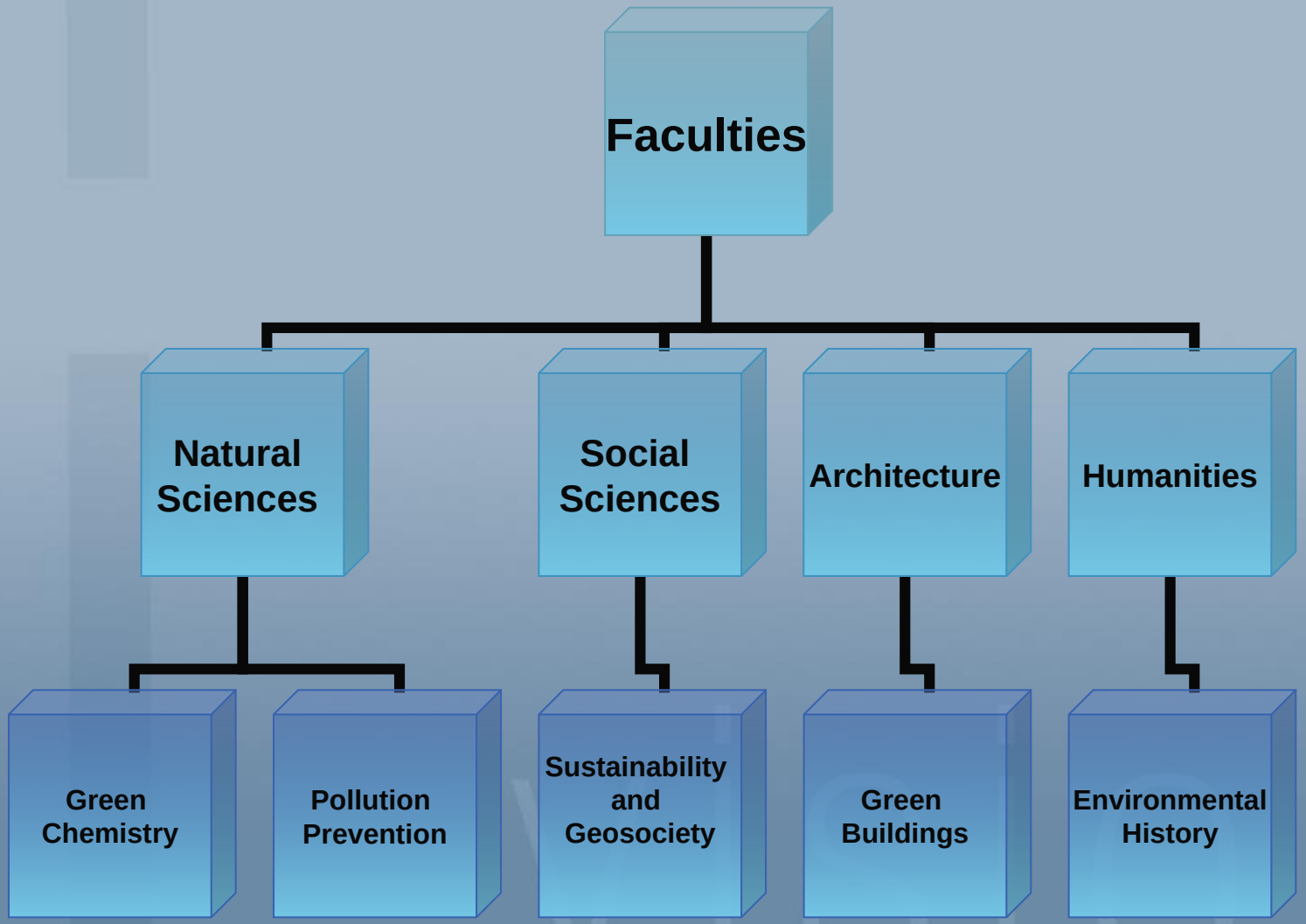
Components Architecture



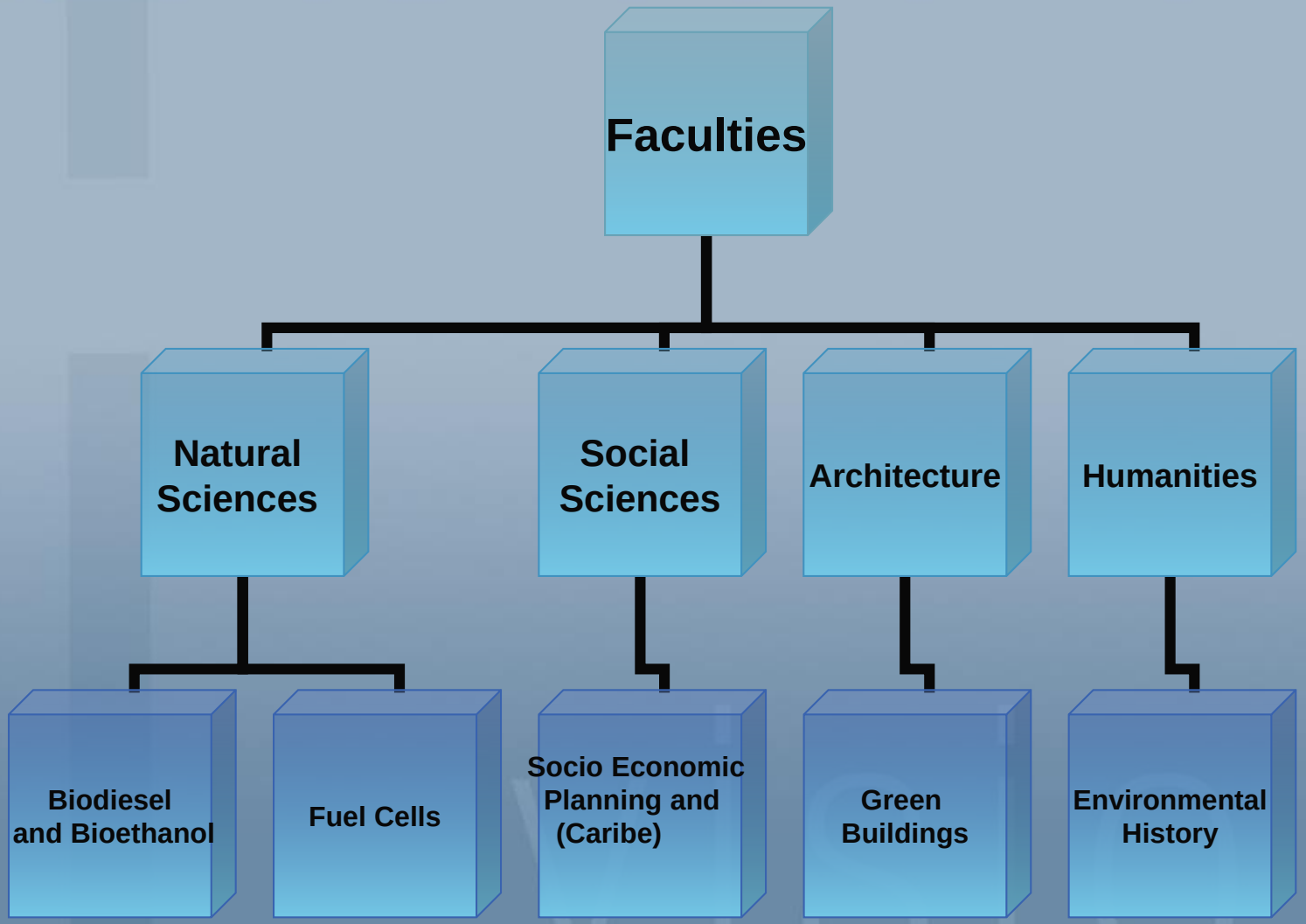
Advantages (Academic)

- Integrates technology innovation “hands-on” to Natural Sciences Curriculum students
- Sustainable strategies as part of quality standards for professional experience
- Green Chemistry and other initiatives as part of normal curriculum

Academic Component: Undergraduate



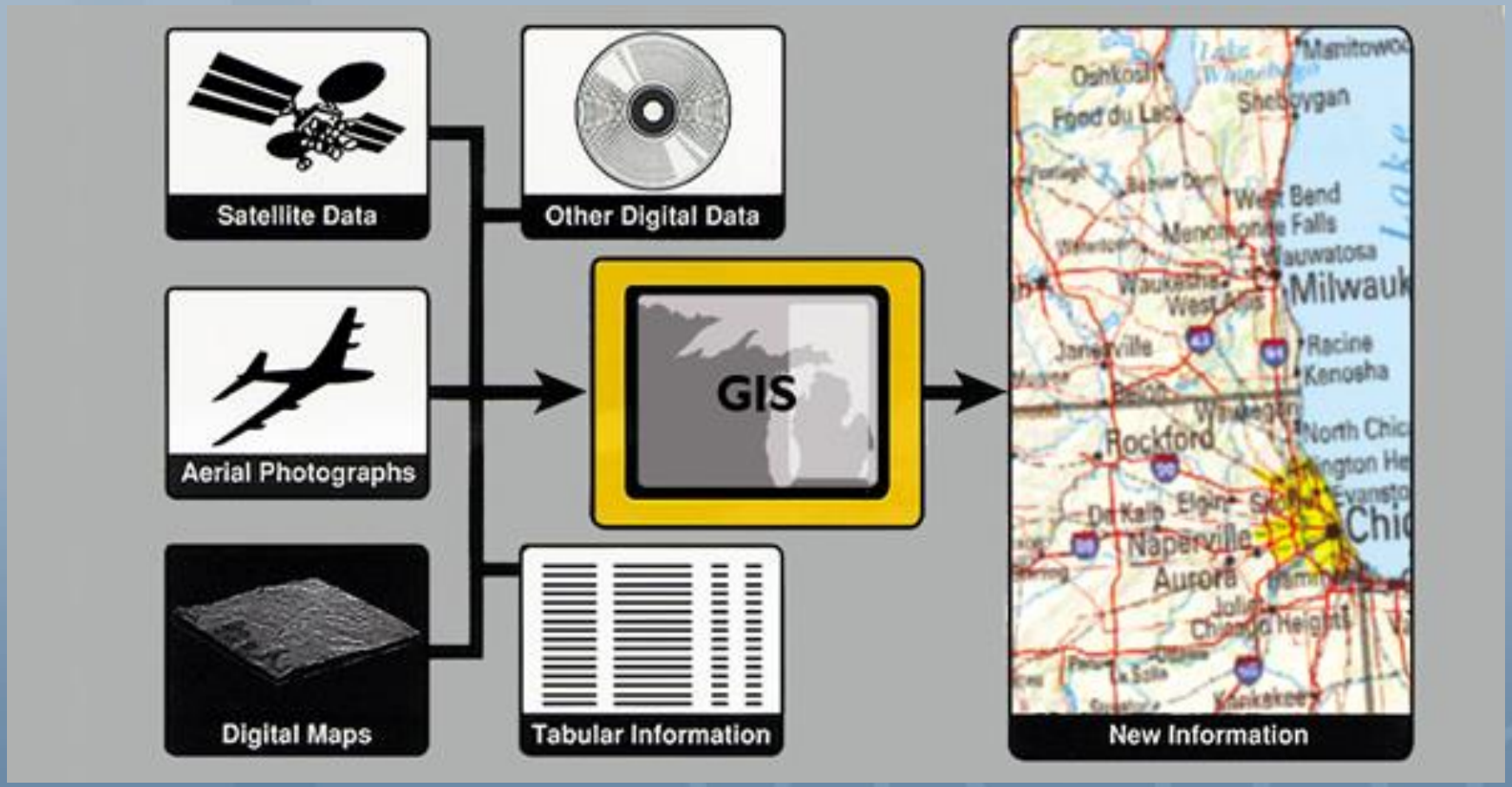
Academic Component: Graduate



Advantages (Community)

- Assess chemical emergency planning
- Compliance with EPCRA's guidelines
- Facilitate accurate information and risk assessment sustainable strategies
- Integrate community actions into UPREMIS operational strategies

GIS: Components



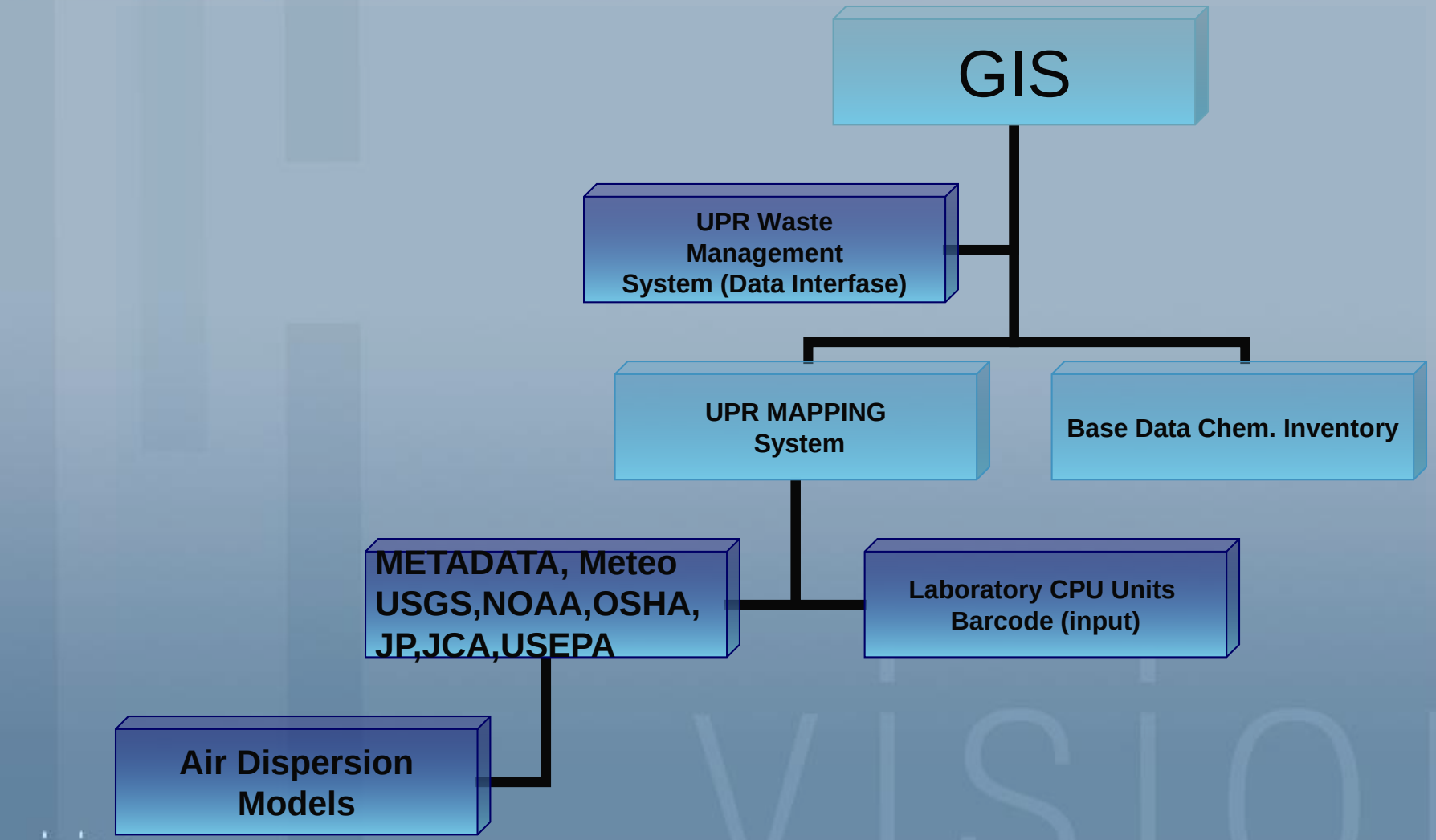
[2] http://erg.usgs.gov/isb/pubs/gis_poster/

Advantages (Operational)

- Accurate data and information (SOP's)
- Facilitates and improves intra agency compliance (OSHA,EPA,JCA, DOT)
- Incorporate sustainable strategies as high quality operational activities
- Focus on HZW reduction** and cost effective systems attached to chemical substances inventory reduction

** Based on Veolia/UPR RP 1991-2005 Hazardous Waste Statistics

Architecture and Methodology



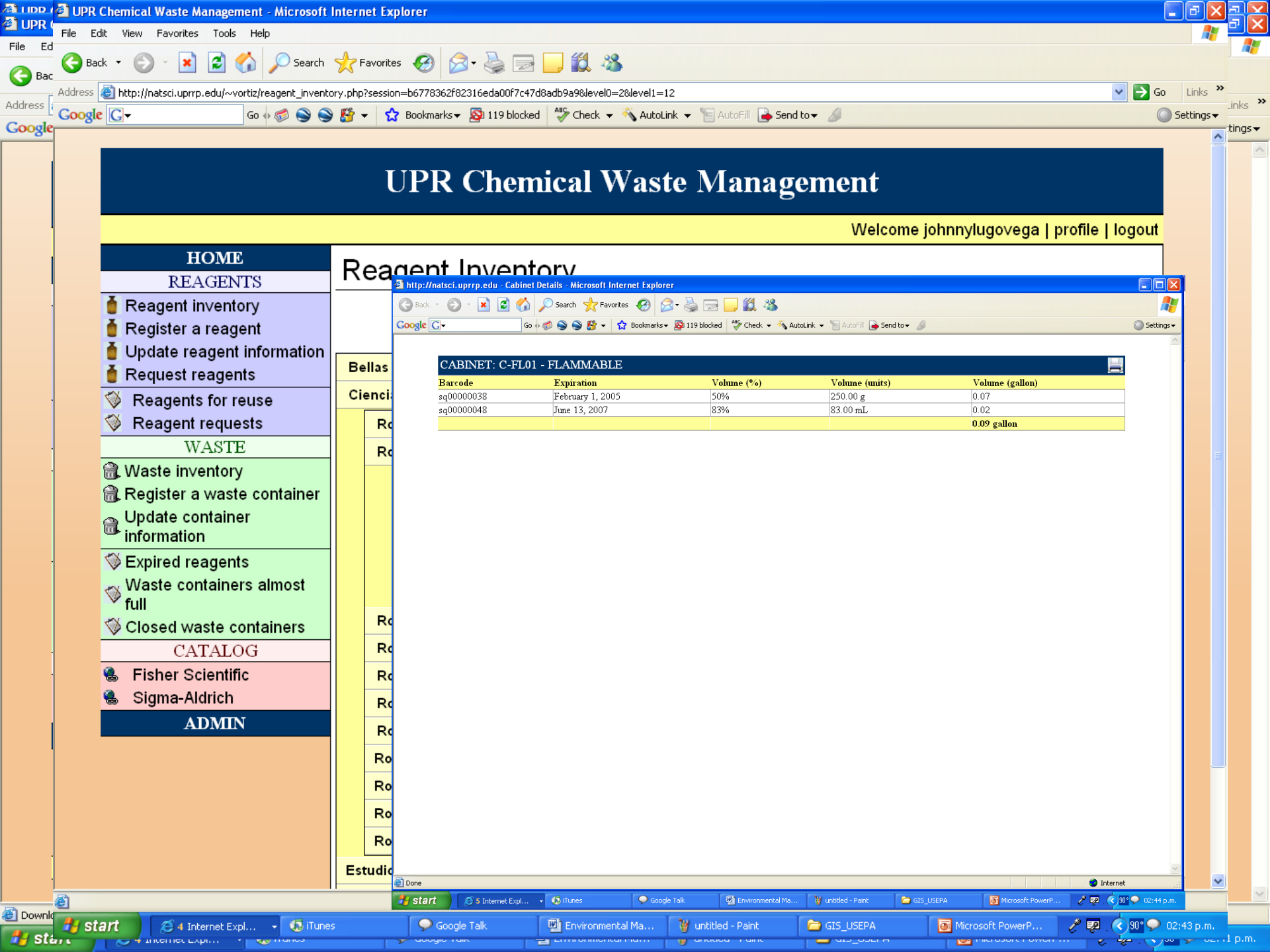
Phase I: CHIMS

(Chemical Inventory Management Information System)

- ID, register and automatization of base data for all chemical inventory and hazardous waste
- Bar Code input / output by an automated system program
- Inventory Control Platform (SQL) through for UPR RP Chemicals Inventory

Chemicals and Waste Management System (CHIMS)

In process


UPR Chemical Waste Management - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites
Address http://natsci.uprrp.edu/~vortiz/reagent_inventory.php?session=b6778362f82316eda00f7c47d8adb9a98level0=2&level1=12
Go Links
Google Go Bookmarks 119 blocked Check AutoLink AutoFill Send to Settings
UPR Chemical Waste Management
Welcome johnnylugovega | profile | logout
HOME
REAGENTS
Reagent inventory
Register a reagent
Update reagent information
Request reagents
Reagents for reuse
Reagent requests
WASTE
Waste inventory
Register a waste container
Update container information
Expired reagents
Waste containers almost full
Closed waste containers
CATALOG
Fisher Scientific
Sigma-Aldrich
ADMIN
Reagent Inventory
Bellas
Cienci
Estudi
http://natsci.uprrp.edu - Cabinet Details - Microsoft Internet Explorer
CABINET: C-FL01 - FLAMMABLE
Barcode Expiration Volume (%) Volume (units) Volume (gallon)
sq00000038 February 1, 2005 50% 250.00 g 0.07
sq00000048 June 13, 2007 83% 83.00 mL 0.02
0.09 gallon
Done
Internet
start
4 Internet Expl...
iTunes
Google Talk
Environmental Ma...
untitled - Paint
GIS_USEPA
Microsoft PowerP...
02:43 p.m.

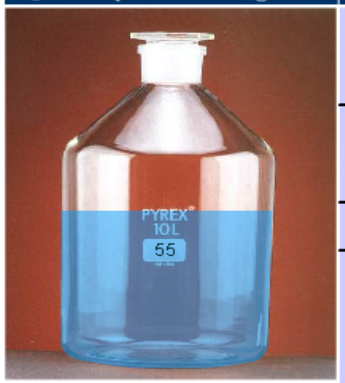
UPR Chemical Waste Management

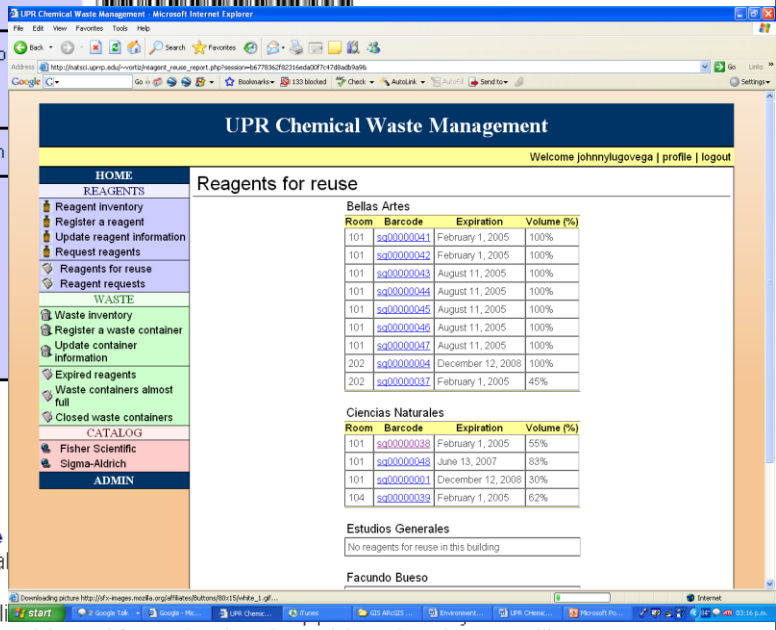
HOME
REAGENTS
Reagent inventory
Register a reagent
Update reagent information
Request reagents
Reagents for reuse
Reagent requests
WASTE
Waste inventory
Register a waste container
Update container information
Expired reagents
Waste containers almost full
Closed waste containers
CATALOG
Fisher Scientific
Sigma-Aldrich
ADMIN

Update reagent information

Use the barcode scanner to read the label from the reagent bottle.

Get It

Quantity Remaining	Information
 Recycle	Bacode Label Descriptio MSDS Expiration Location Edit



Instructions:

To change the quantity remaining of the more precise drag the mouse until the va

To change the location of the reagent cl select the building then the room and the cabinet. After selecting the cabinet the change will be complited.

UPR Chemical Waste Management

HOME
REAGENTS
Reagent inventory
Register a reagent
Update reagent information
Request reagents
Reagents for reuse
Reagent requests
WASTE
Waste inventory
Register a waste container
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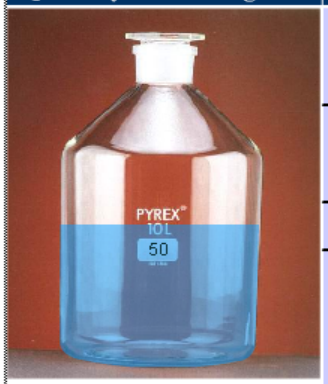
CATALOG
Fisher Scientific
Sigma-Aldrich
ADMIN

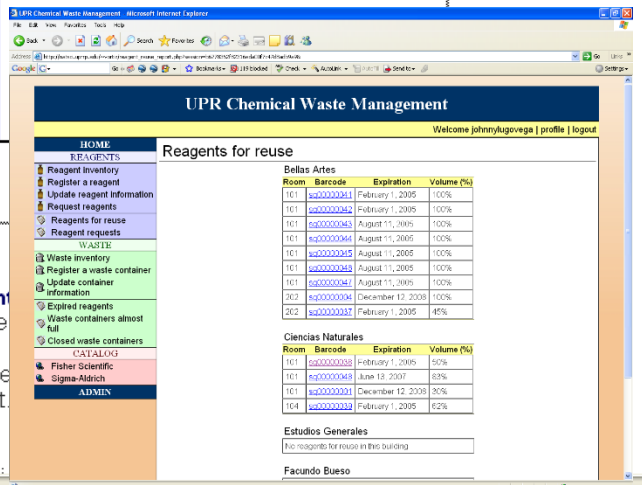
Update reagent information

Use the barcode scanner to read the label from the reagent bottle.

Get It

Quantity Remaining	Information	
	Bacode Label	* S Q 0 0 0 0 0 0 3 8 *
	Description	Ferric sulfate
	MSDS	http://www.jtbaker.com/msds/englishhtml/f1 Save
	Expiration Date	1 Feb 2005
	Location	Ciencias Naturales 101 C-FL01 - Flammable Edit

Recycle



Instructions:

To change the quantity remaining of the reagent more precise drag the mouse until the value is re

To change the location of the reagent click the e select the building then the room and the cabinet. be complited.

UPR Chemical Waste Management

HOME
REAGENTS
- Reagent inventory
- Register a reagent
- Update reagent information
- Request reagents
- Reagents for reuse
- Reagent requests

WASTE
- Waste inventory
- Register a waste container
- Update container information
- Expired reagents
- Waste containers almost full
- Closed waste containers

CATALOG
- Fisher Scientific
- Sigma-Aldrich

ADMIN

Waste containers almost full

Bellas Artes

Room	Chemical Name	Barcode	Open Date	Close Date	Volume
101	Halogenados	dp00000037	October 12, 2005	July 3, 2005	4.60
102	Halogenados	dp00000038	October 12, 2005	July 3, 2005	4.60
103	Solventes	dp00000039	October 12, 2005	July 3, 2005	4.60
104	Solventes	dp00000040	October 12, 2005	July 3, 2005	4.60
105	Solventes	dp00000041	October 12, 2005	July 3, 2005	4.90
201	Solventes	dp00000042	October 12, 2005	July 3, 2005	4.90
202	Solventes	dp00000043	October 12, 2005	July 3, 2005	4.90
					33.10

Ciencias Naturales

Room	Chemical Name	Barcode	Open Date	Close Date	Volume
Storage	Halogenados	dp00000036	October 12, 2005	July 3, 2005	4.60
					4.60

Estudios Generales

There is no waste to pickup in this building

Facundo Bueso

There is no waste to pickup in this building

Julio García Díaz

There is no waste to pickup in this building

Phase II: GIS and Inventory Control

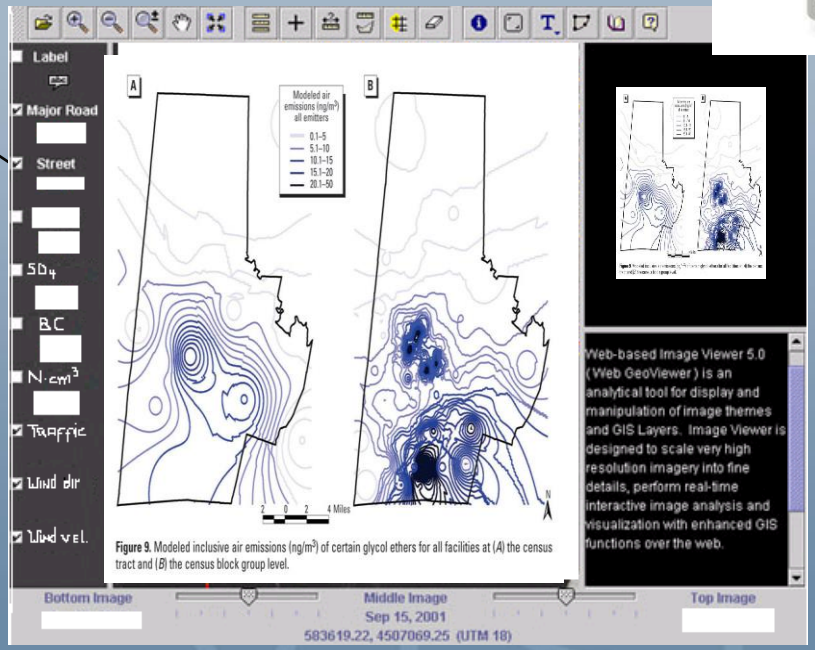
- GIS application to pilot lab's
  - JGD 116 (February 2009)
    - Next:
      - ✓ FB 101A
      - ✓ Cayey, RUM, Humacao
- Base Data and Spatial Analysis of Inventory
  - Location
  - Description
  - ID
  - Reports

Proposed Hardware and Software

Arc Pad 9.0

IPAQ PAD Wi Fi

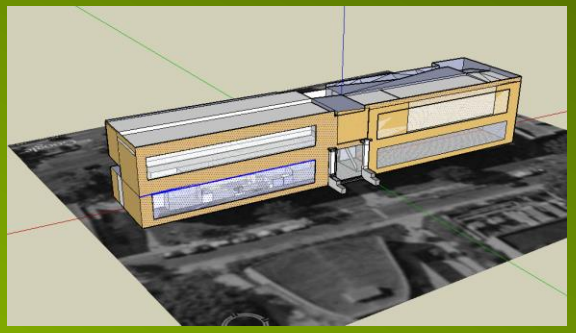
Web Base or Mobile GIS

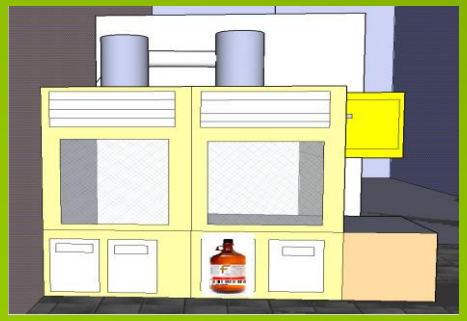


Desktop ArcGIS 9.7

vision

GIS Applied to Inventory Control





SIG aplicado al control de inventario

Phase III: RP Communities HZ Communication System

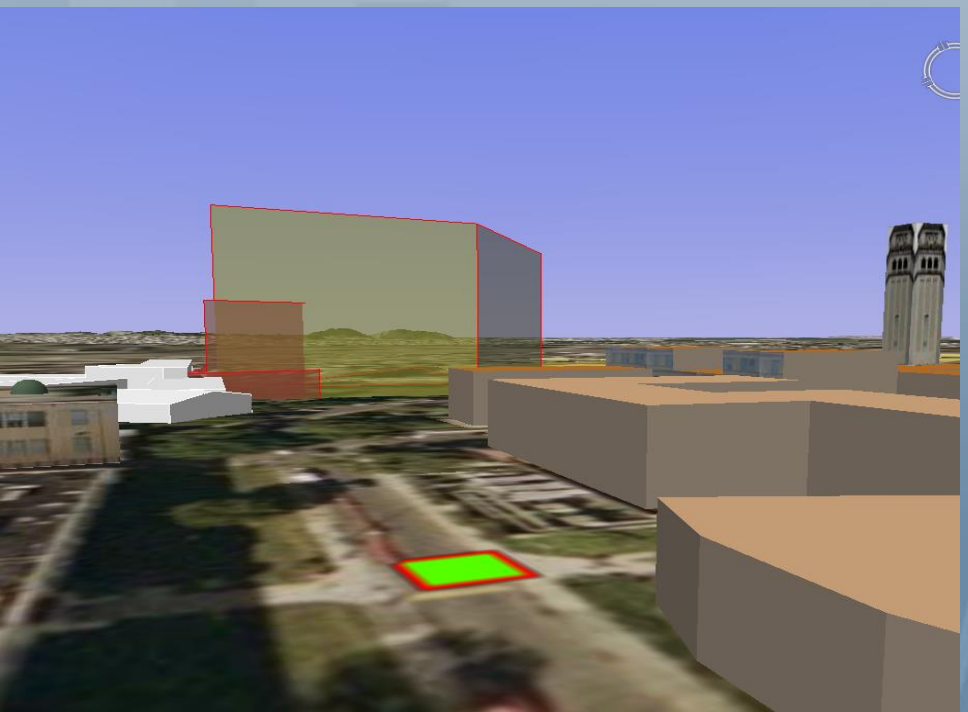
- Spatial Analysis Using GIS Base Data and:
  - Meteo/Weather Data
  - Air Pollutant Data (Air Dispersion Modeling)
  - Traffic
  - Estimated population at UPR and Buildings and Labs.
- Complies with:
  - 29 CFR Part 1910 § 120
  - OSHA 29 CFR § 1200
  - 1450, EPCRA 304,311-314
  - NIMS REP (HSPD-5, 2005)

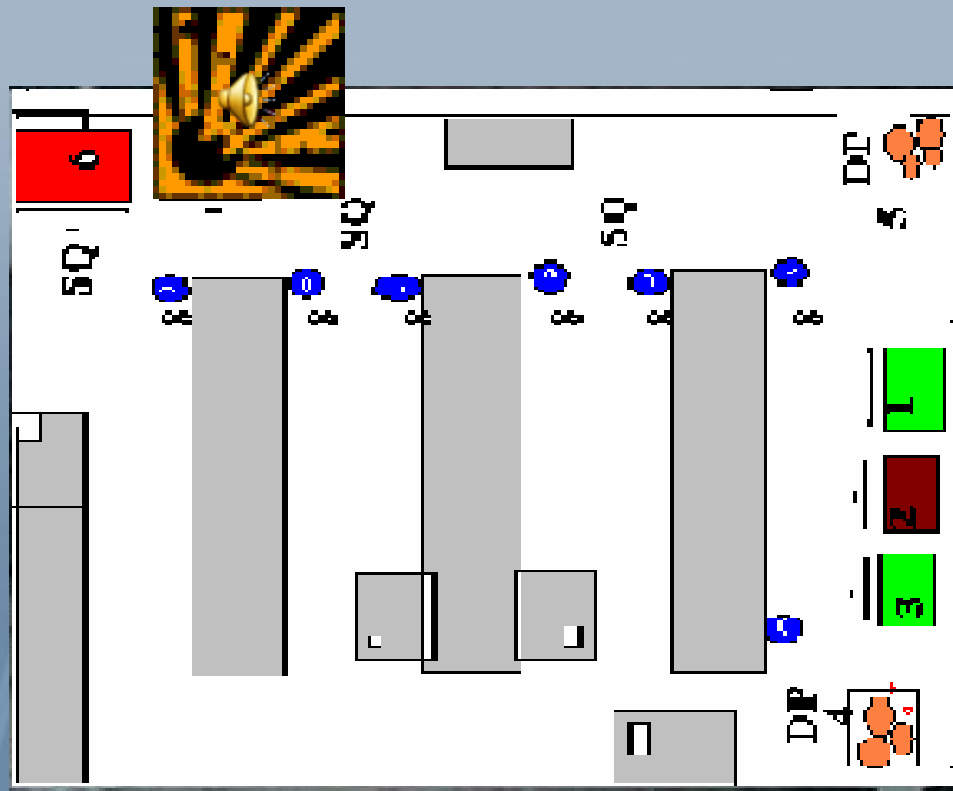
Cont. Phase III: Emergency Response, Risk Analysis, Base Data

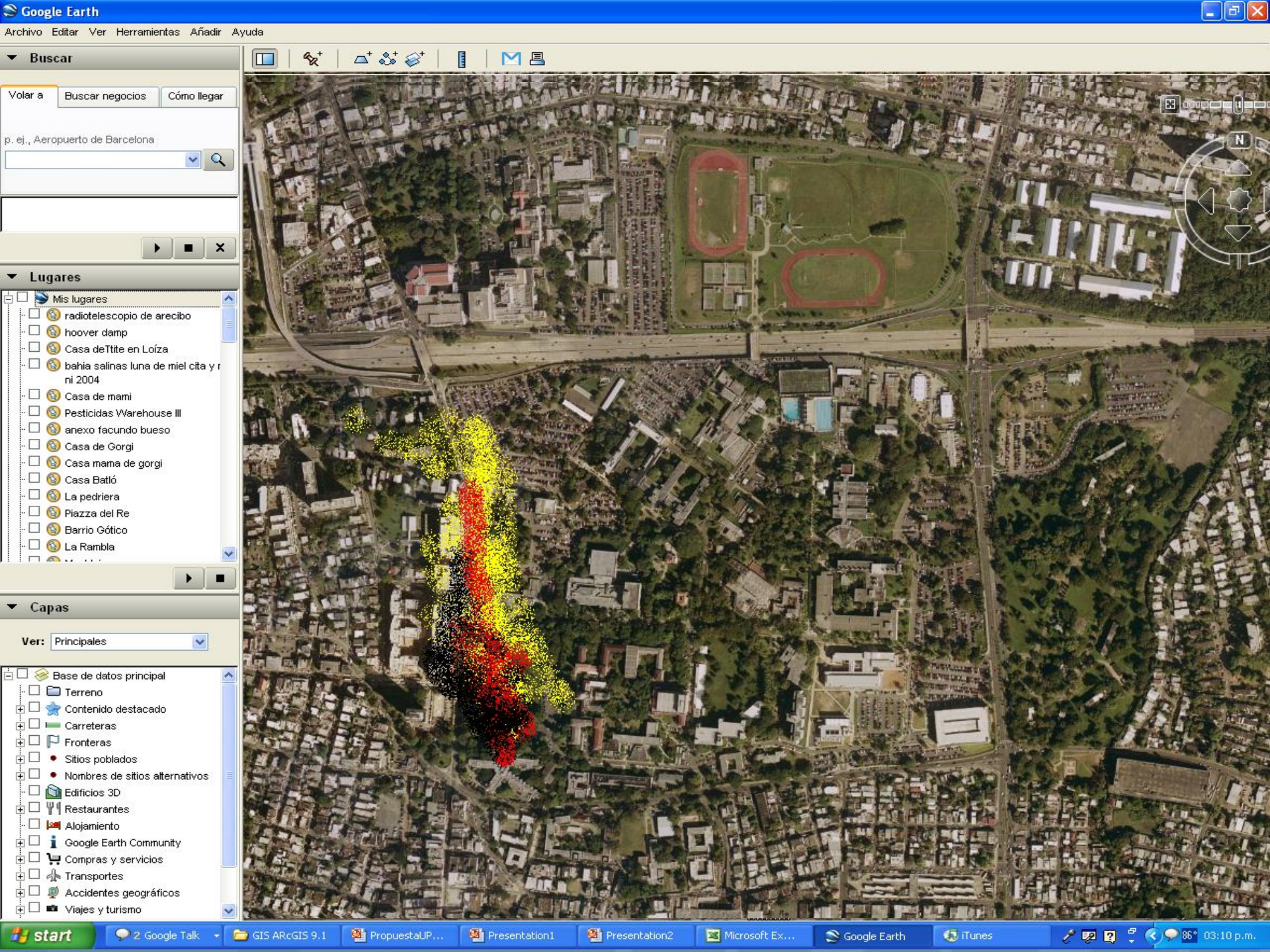
Simulated Scenario

Risk Assessment in FB

Conceptual line: Pop_FB + Risk_FB + Meteo data_3 + Traffic = assessment_ scenario_1_Time_date






Google Earth
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Volar a
Buscar negocios
Cómo llegar
p. ej., Aeropuerto de Barcelona
Lugares
Mis lugares
radiotelescopio de arecibo
hoover damp
Casa deTtite en Loíza
bahia salinas luna de miel cita y r
ni 2004
Casa de mami
Pesticidas Warehouse III
anexo facundo bueso
Casa de Gorgi
Casa mama de gorgi
Casa Batló
La pedriera
Piazza del Re
Barrio Gótico
La Rambla
Capas
Ver: Principales
Base de datos principal
Terreno
Contenido destacado
Carreteras
Fronteras
Sitios poblados
Nombres de sitios alternativos
Edificios 3D
Restaurantes
Alojamiento
Google Earth Community
Compras y servicios
Transportes
Accidentes geográficos
Viajes y turismo
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GIS ARcGIS 9.1
PropuestaUP...
Presentation1
Presentation2
Microsoft Ex...
Google Earth
iTunes
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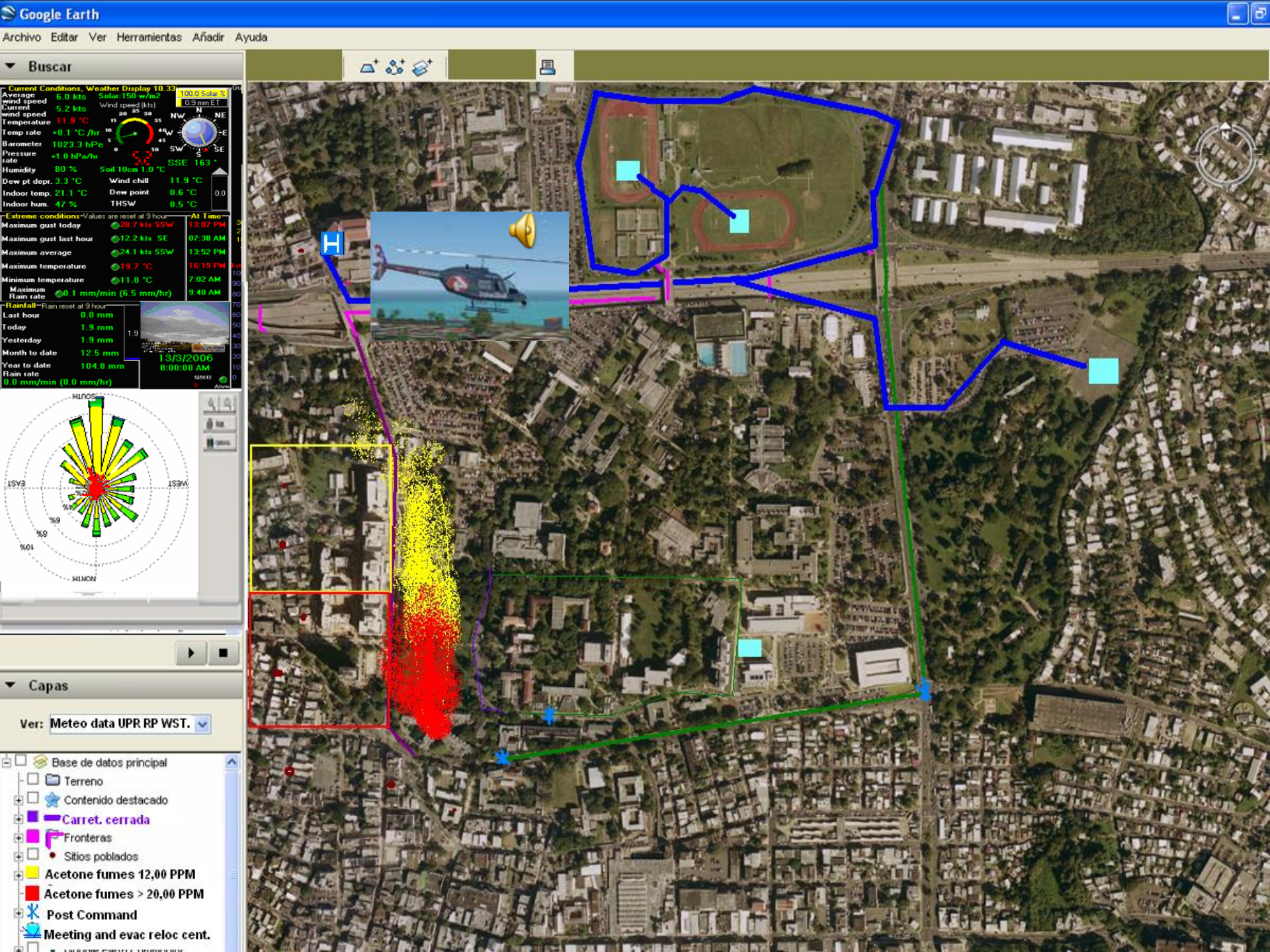

Google Earth
Archivo Editar Ver Herramientas Añadir Ayuda
Buscar
Current Conditions, Weather Display 10.33
Average wind speed 6.0 kts
Current wind speed 5.2 kts
Temperature 11.9 °C
Temp rate +0.1 °C /hr
Barometer 1023.3 hPa
Pressure rate +1.0 hPa/hr
Humidity 80 %
Dew pt depr. 3.3 °C
Indoor temp. 21.1 °C
Indoor hum. 47 %
Solar: 150 w/m2
Wind speed (kts)
Soil 10cm 1.0 °C
Wind chill 11.9 °C
Dew point 8.6 °C
THSW 8.5 °C
Extreme conditions-Values are reset at 9 hour
At Time
Maximum gust today 28.7 kts SSW 13:07 PM
Maximum gust last hour 12.2 kts SE 07:38 AM
Maximum average 24.1 kts SSW 13:52 PM
Maximum temperature 19.7 °C 16:19 PM
Minimum temperature 11.8 °C 7:02 AM
Maximum Rain rate 0.1 mm/min (6.5 mm/hr) 9:48 AM
Rainfall-Rain reset at 9 hour
Last hour 0.0 mm
Today 1.9 mm
Yesterday 1.9 mm
Month to date 12.5 mm
Year to date 104.8 mm
Rain rate 0.0 mm/min (0.0 mm/hr)
13/3/2006
8:00:00 AM
Capas
Ver: Meteo data UPR RP WST.
Base de datos principal
Terreno
Contenido destacado
Carret. cerrada
Fronteras
Sitios poblados
Acetone fumes 12,00 PPM
Acetone fumes > 20,00 PPM
Post Command
Meeting and evac reloc cent.

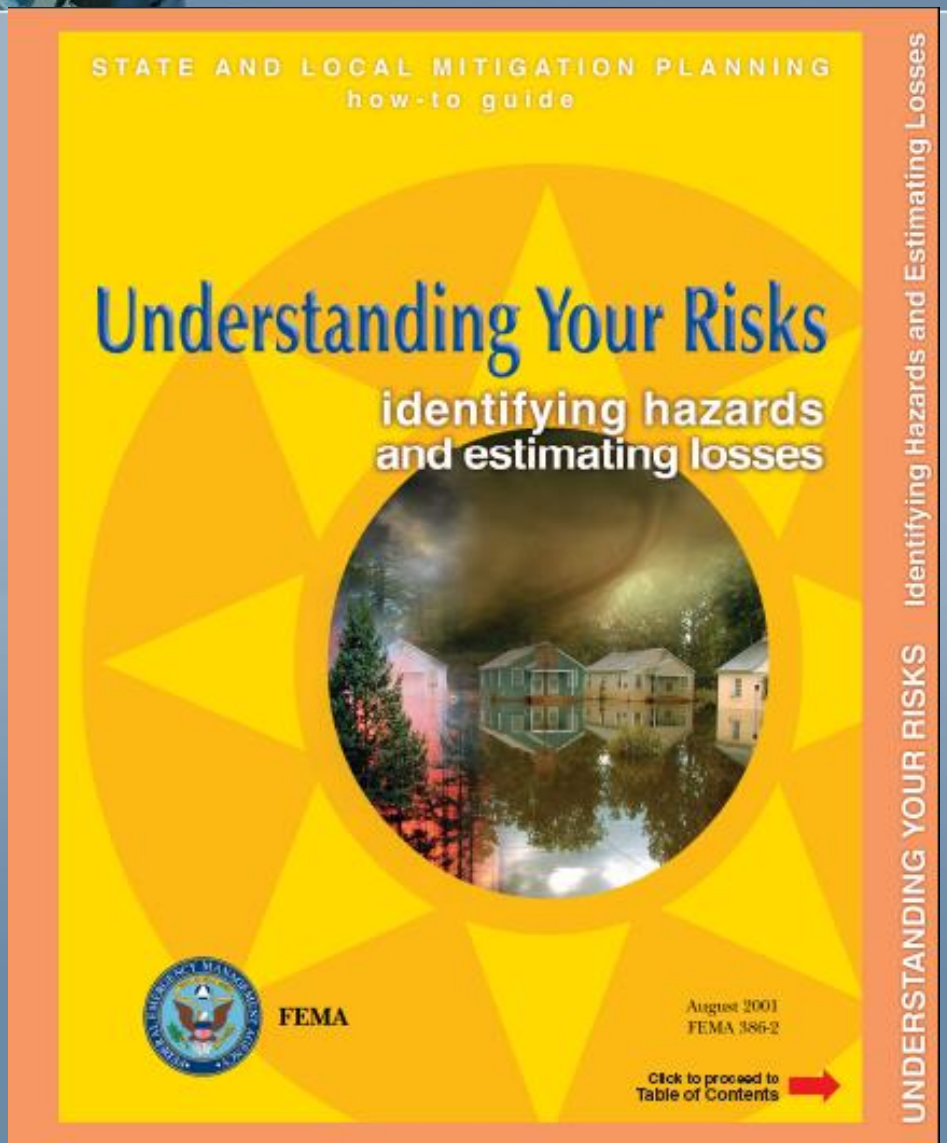
Risk Assessment (FB)

- **Integrated risk assessment aims at combining more than one approach, more than one source, and both source and receptor.**
- **This includes internal and external considerations; aspects of**
  - **Physical environment assessment**
  - **Regulatory and safety assessment**
- Following FEMA guidelines (FEMA 386)
  - **Planning**
  - **Risk assessment**
  - **Emergency response management**

Risk Assessment

- Allows natural risk assessment
- Complete profile for response
- Layered
  - Topography
  - Hidrology
  - Geology
  - Flood, Tsunami, Earthquake Analysis

Risk Assessment



vision

Risk Profile (FEMA 436) internal SOP

University of Puerto Rico
Occupational Safety and Environmental Protection Office (OPASO)
Río Piedras Campus
Summited by: Johnny Lugo Vega, EH&S Specialist II

HAZARDOUS CHEMICALS RISK PROFILE STANDARD OPERATIONAL PROCEDURE
(UPREMIS TEMPLATE)

SOP Topic:	NAME
Lab SOP number:	BUILDING_LAB_NUM_MM/YY
Created by:	NAME
Principal Investigator or Designated Reviewer	NAME
Date:	MM/DD/YYYY

Purpose: All hazardous chemicals and waste are managed, storage and disposed according to local and federal regulations, using UPR RP Chemical Hygiene Plan and safety guidelines. Each SOP will be reviewed in a consistent manner, especially under significant changes in the constituents of this protocol or before new users. These personnel must be trained by PI or designed person in the lab. OPASO office will also participate in the review of the occupational health and environmental protection items. According to UPR Environmental Management Information System we developed this SOP in order to maximize our efforts to prevent accidents or chemical release incidents.

Instructions: Please describe all parts in details according to the operational activity developed under this protocol. Use complete words and sentences, as well as complete chemical names, in order to minimize bias or misunderstood information. You must summit a copy of this protocol to OPASO and DEGI offices for final approval. For additional information, you can contact OPASO office at (787) 764- 0000 Extension 7392, 2421, 7493. Also, you can save the planet with a paperless note, writing directly to: jolugo@vmail.upmp.edu.

Operational or Process Description

Materials:	DESCRIPBE ALL MATERIALS
Equipment:	DESCRIBE ALL EQUIPMENTS
Special Requirements (non safety):	SUMIT ANY SPECIAL CARE OR MANAGEMENT
Procedure:	FULLY DESCRIPTION TO OPERATIONAL PROCEDURE

Hazard Communication

Labels and Sign:	
Personal Protective Equipment:	
MSDS Reference:	SEE MSDS BINDER
Safety Plan Reference:	CHP SECTION_PAGE
Exposure: PEL or TVA DATA	SEE MSDS SECTION V
Training and Records	SEE TRAINNG AND ORIENTATION BINDER #_;RECORDS

Environmental Data:

Hazard Characteristic:	F=Flammable, C= Corrosive, I= Imitant, Ex= Explosive, Rd= Radioactive, T=Toxic, P= Poisson BHZ= Biohazard
Lab Location:	Cabinet # or letter (ex:, Cab=A1)
Bar codes:	SEE INVENTORY FORM LIST
EPA/ID waste code:	SEE MSDS SECTION TRANSPORT OR DISPOSAL/DOUBT? WRITE TO OPASO: jolugo@vmail.upmp.edu

Waste Reduction Action

Short Term	INVENTORY CONTROL, HAZARDOUS WASTE REDUCTION, ECOSUBSTITUTE PRODUCT(S)
Long Term	GREEN CHEMISTRY SUSTAINABLE PLAN WASTE WISE
	P2 WATE TO ENERGY PROGRAM

Emergency

Spill or Leak Safety Guidelines	SEE UPR CHP PLAN SECTION_PAGE_CALL OPASO FOR ASSITANCE AND PROPER DISPOSAL
Fire	SEE UPR CHP PLAN OR UPR FIRE PLAN SECTION PAGE AND CALL INMIDIATELY TO EMERGENCY NUMBERS (OPASO, UPR SECURITY). EXIT THE BUILDING USING EMERGENCY EXITS
Chemical release	CALL INMIDIATELY TO EMERGENCY NUMBERS(OPASO, UPR SECURITY) EXIT THE BUILDING USING EMERGENCY EXITS

Signs and Approvals

Researcher/Lab: /

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Revised By:

OPASO Reviewer:

DEGI Reviewer:

Draft Sumitted Date:

Final Appoval Date:

Next Revision Date:

Summary

- Environmental Management System using GIS represents the right perspective tool for a sustainable university
- The first step to follow in our challenge to protect life and environment
- Why not beginning with our University, our community at Puerto Rico?

References and Links:

- ESRI

  El Instituto de Investigación de Sistemas Ambientales (Environmental Systems Research Institute) fue fundado en 1969 como una compañía de consultoría privada que se especializaba en el análisis de usos de suelos. http://www.Esri.com
- Wagner, M.W., *The Eastern Municipal Water District AM/FM/GIS project,*Proceedings, Conference XII, AM/FM International, New Orleans, April 1989, pp. 526-541.
- http://www.JP.gobierno.pr
- Whiterell and Hahn: http://gis.esri.com/library/userconf/proc00/professional/papers/PAP767/p767.htm. 1999
- GIS

  GIS.com es un portal de información sobre los sistemas de información geográfica creado por ESRI. Esta página intenta educar a todo aquel que este interesado en la tecnología de GIS, ofreciendo actividades diarias y diferentes recursos a los usuarios de GIS
- GeoCommunity™

  GeoCommunity es el lugar para profesionales dentro del campo de Sistemas de Información Geográfica, CAD, Mapping y estudiantes.
- GISPortal

  El GISPortal (también conocido como Great GIS Net Sites!) es una de las principales páginas de Internet en la industria de los Sistemas de Información Geográfica. http://www.gis.gobierno.pr

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Questions?