"Capacity Building and Strengthening Institutional Arrangement"

Workshop: Quantitative risk assessment of oil and gas plants"

Criteria for Identification of Critical Areas

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Objectives

Application of an alternative approach aimed to the identification of critical areas affected by high presence of "Seveso" Establishments

Work Plan

1) Determination of areas with high presence of facilities on the base of spatial relationships criteria (potentially critical areas).

2) Screening and detailed analysis on plants defined during first step in order to rank critical scenarios on the base of intersection between impact areas and census data as well as other neighboring facilities (evaluation of domino effects).

Methodological approach

The identification of areas with high presence of point or polygon features, the geometric primitives generally used in cartography for describing an industrial establishment, can be considered a spatial analysis problem to be solved by using dedicated tools like Geographical Information Systems.

Those systems provide users with functions and tools able to accurately represent real world features and their related phenomena. Neighborhood Analysis, for example, allow the determination of all those spatial relationships between a geographic feature and its surrounding areas.

Among the several function contained in GIS Systems particular attention, by taking on account the objective of the study, must be paid to that function that allow to connect each point or centroid of a polygon with its nearest one by means a line feature with distance and identifying data about connected points associated.

Spatial Inventory of "Seveso" Establishments

Research started from the inventory of center points X-Y geographic coordinates of about 1,050 "Seveso" establishments distributed on a national scale and subsequently focused on a statistically representative sub-set located in six regional district:

VENETO

LOMBARDIA

TUSCANY

PIEMONTE

EMILIA ROMAGNA

SICILY

Spatial Analysis Algorithm

By connecting each point features or polygon feature center points with the neighboring ones the algorithm allows a geometric network to be generated representing mutual distance among each "Seveso" establishments

The selection of those connecting line features including 3 or more facilities whose mutual distance is below an user-defined threshold (500, 1000, 3000 meters) allows the preliminary identification of cluster representing potential critical areas

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Reference Indexed Grid

A reference indexed grid has been superimposed to provide unique identifiers to each defined cluster as well as ensuring them to be unchangeble in case of modification (up-dating) of center points spatial distribution.

Impact Areas Generation

Application of "GIS Buffer Function" on those establishments included in each cluster (Study of Domino Effects on the base of Safety Reports data)
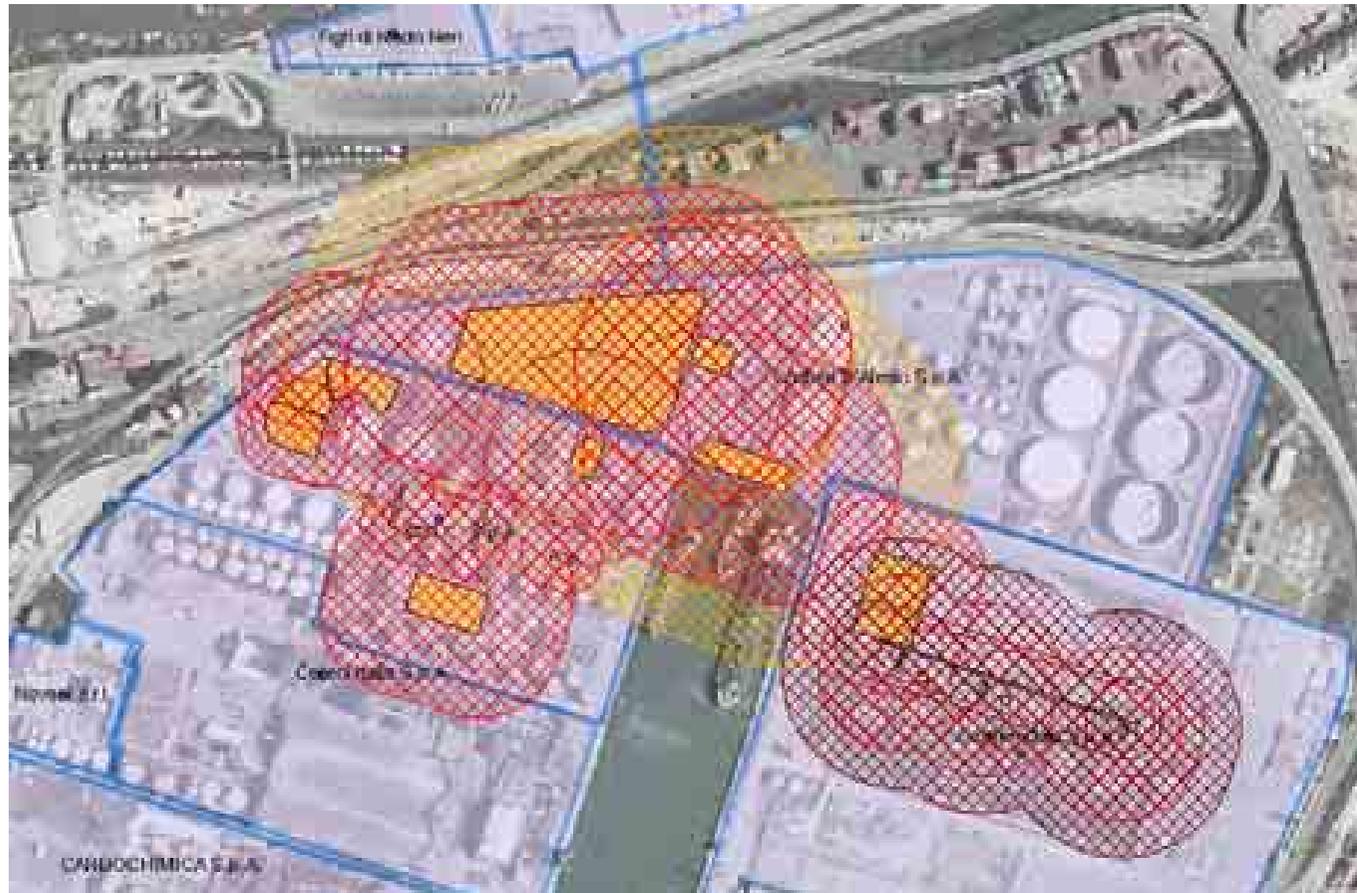
Intersection with census data

GIS Spatial Analysis Function applied :

"Buffer"

"Erase"

"Intersect"

Geoprocessing Results

Progress. N.	CENSUS Tracts ID	Extent Area	N. Inhabitants	Impacted Area	Impacted Inhabitants
1	50270425397	1774126	11	715585	4.436794675
2	50270425398	1054177	31	1298	0.038174828
3	50270425412	2407807	0	184555	0
4	50270425413	2952267	0	437656	0
5	50270425417	3473768	4	942367	1.085123842
			Total population involved		5.560093345