Follow-up monitoring and adaptive management in EIA process: a case study in the new port of Veracruz construction phase

Ramírez-Macías, José Isaac[1]; Liaño-Carrera, Francisco[2]; Baños-Illana, Jorge E.[2]; Gómez-Barrero, Arturo E[1]. & Guzmán-Ricardo, Carlos R.[1]

[1]Argo Consultores Ambientales S.A. de C.V. Coordinación de Protección Ambiental (contact author e-mail: isaac.ramirez@argoconsultores.com)

[2] Administración Portuaria Integral de Veracruz S.A. de C.V. New Port of Veracruz Management.

1. Abstract.

Follow-Up is a fundamental stage in the Environmental Impact Assessment process. Follow-up monitoring aims to evaluate projects performance in terms of the environmental impact level predicted and later authorized. Ideally, surveillance and compliance monitoring results should be continuously evaluated to determine the need for adjustment in the environmental management actions (mitigation measures included). Follow-up monitoring and adaptive management become extremely important in large-scale projects. The port of Veracruz began an ambitious expansion project in 2015 and implemented an Environmental Management System (EMS) based on ISO 1400 standards, which include an Environmental Monitoring Program (EMP). Because of EMS operation and EMP results, important management actions have been executed to keep environmental performance of the project in an acceptable level. The new port of Veracruz is a successful case of adaptive management based on environmental monitoring.

2. Port of Veracruz expansion project.

Port of Veracruz Authority (APIVER) obtained in 2013 an environmental impact authorization to build and operate its expansion project, known as the New Port of Veracruz. This project represents one of the biggest infrastructure projects in Mexico in recent times and the most important port construction in last one hundred years.

The project consists of two construction stages; the first (2014-2018), which started in 2014, involves the construction of a 4.2-kilometer western breakwater; there will be 2.8 kilometers of construction along the wharf where the first container terminal (720 meters) will be located, accommodating four berths and slated to begin operations in 2018. In total, the first stage will bring berth capacity to eight positions. A satellite terminal with five positions will also be built to handle other cargo. It will have a depth of fifteen meters. The second stage (2019-2030) includes the construction of the eastern breakwater of 3.5 kilometers and the rest of terminals. The project will finally have a 35-berth capacity and 900 hectares area (440 hectares water expansion) and will increase current port capacity in a 400%.

The port of Veracruz is located next to a marine protected area (MPA) denominated Veracruz Reef System (VRS). This MPA imposed to the port expansion project complex restrictions environmentally speaking due to the importance of the ecosystems which it protects. Main environmental issues of the new port of Veracruz incorporated in the environmental impact statement are related to some extent with the protection and/or conservation of coral reefs in the MPA. See Figure 1.

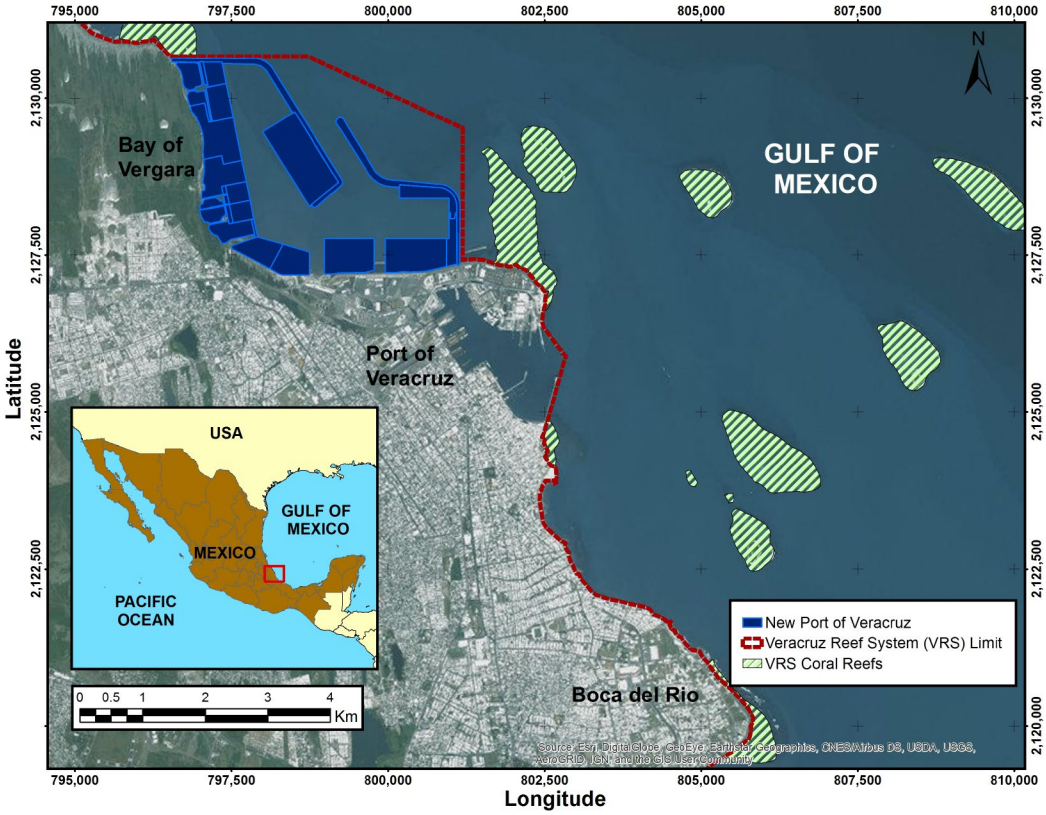

Figure 1 Port of Veracruz Expansion Project Location

3. Environmental Monitoring Program.

Monitoring refers to the measuring of physical, chemical, social, economic and ecological aspects related to environmental impacts (Glasson, Therivel, & Chadwick, 2005). Environmental Impact Assessment (EIA) follow-up and audit usually refers to a set of actions developed after project environmental impact authorizations including: monitoring, auditing, ex-post evaluation, post-decision analysis and post-decision management (Arts, Caldwell, & Morrison-Saunders, 2001). Morrison-Saunders et al. (2007): defined EIA follow-up simply as the monitoring and evaluation of a project plan (that has been subject to EIA) for management of, and communication about, the environmental performance of that project or plan.

The environmental impact assessment (EIA) procedure in Mexico was recently established in the 1980s when legal framework appeared. As it happens at international level, most attention was centered on the prevention nature of environmental impact assessment to anticipate major negative impacts prior environmental permits approval. But little attention has received the follow-up phase, which can answer if actual impacts are in accordance with conditions and predictions made in environmental impact statement (EIS) (Marshall, 2005) . Were all measures proposed in EIS adequate and/or enough to prevent, compensate and mitigate real environmental impacts? Monitoring, ideally, should answer that kind of questions.

Although EIA follow-up is clearly necessary in practice. However, in Mexico it seems to be more of a theoretical approach, which has been undertaken just partially in few cases. Here we present the new port of Veracruz follow-up monitoring and highlight how it has been the base of project environmental performance evaluation.

The Ministry of Environment and Natural Resources (Secretaría de Medio Ambiente y Recursos Naturales, SEMARNAT) is the government agency in charge of regulating EIA process in Mexico and has elaborated environmental impact assessment guidelines which incorporate monitoring and follow-up. Project proponents in Mexico use those guidelines for the preparation of EIS and must include an environmental monitoring program.

Due to its inherent complexity and magnitude, the port of Veracruz expansion project was subject to environmentalist opposition for over a decade before it's authorization by the SEMARNAT and the baseline information integrated into the EIS included more than ten years monitoring covering aspects of port design technical studies, socioeconomic and ecological material. And consequently, the environmental monitoring program initially proposed, encompassed a full range of variables to be followed during the fifty years of project life.

Once SEMARNAT evaluated the EIS, it also added a series of additional mitigation measures to the original proposal that strengthened the environmental monitoring program, its scope and objectives, becoming a central instrument for the evaluation of the environmental performance of the port expansion project.

To face the challenge of fully complying with the requirements of the environmental impact permit, the port of Veracruz authority designed and implemented, in 2014, an Environmental Management System (EMS) based on ISO 1400 standards, focused on the port of Veracruz expansion project which includes an Environmental Monitoring Program (EMP). New port construction phase began in 2015 and here we present relevant results of EMP and describe related management actions based on environmental performance evaluation of the project.

The environmental management system covers three main objectives that, in sum, help to evaluate and communicate the environmental performance of the port expansion project. The objectives pursued by the EMP are:

a. Total permit conditions and measures compliance through the systematic control of the actions taken by the port authority, construction companies and other actors involved in the project.
b. Monitoring and continuous evaluation of the project´s environmental performance.
c. Communication and reporting of environmental performance to government agencies, evaluation committee, and other interested parties.

A special office, Environmental Protection Coordination (EPC), was created by the Port of Veracruz Authority to operate the EMS. Follow-up monitoring is executed by several specialized companies and universities and all information as part of EMS procedures.

An important aspect to highlight of the environmental impact permit of the Veracruz port extension project is the existence of an autonomous entity that oversees the correct project compliance. This entity is represented by the Veracruz University, which also submits an annual report to a Technical Committee represented by different government agencies and academic institutions.

4. New port of Veracruz follow-up monitoring relevant results and related management actions.

As it was mentioned before, the new port of Veracruz got its impact assessment permit in 2013 and began the constructions phase in 2015. In this period, the activities with the greatest impact potential were: rock dumping to conform the western breakwater and dredging of the navigation channel. Considering these activities, monitoring actions were centered on sediment dynamics in Vergara's Bay and the coral reefs closer to the new port construction site.

Prior to the start of the construction phase, the monitoring related to sediments was centered on sedimentation rates and coral reefs health assessment. And, a silk curtain system was built and deployed as one of the main mitigation measures regarding sediments control during the port construction phase.

Once the northern breakwater construction began, the silk curtains system did not perform as it was planned. The silk curtains system was supervised daily and finally was adapted and operated under special protocols that took into account deployment and retreat, monitoring and a maintenance program. The adapted protocols to manage the silk curtains system was approved by main stakeholders and then approved by SEMARNAT. However, it was necessary to assess the real effects of sediment input caused by rock dumping.

In 2015 the Port of Veracruz Authority began a sediment transport monitoring in order to set the baseline for a further preventive monitoring system during dredging execution. But this monitoring also contributed to assess rock dumping impact on sediment transport in Vergara´s Bay. Sediment transport have been monitored for 24 months so far, using vessel mounted and fixed Acoustic Doppler Current Profilers (ADCP) and it was determined that rock dumping, independently of silk curtains, had a punctual (300 – 400 square meters) and temporal effect (three to four hours before settling) demonstrating with a "*measured impact*" the real effect of rock dumping (Figure 2, letter A).

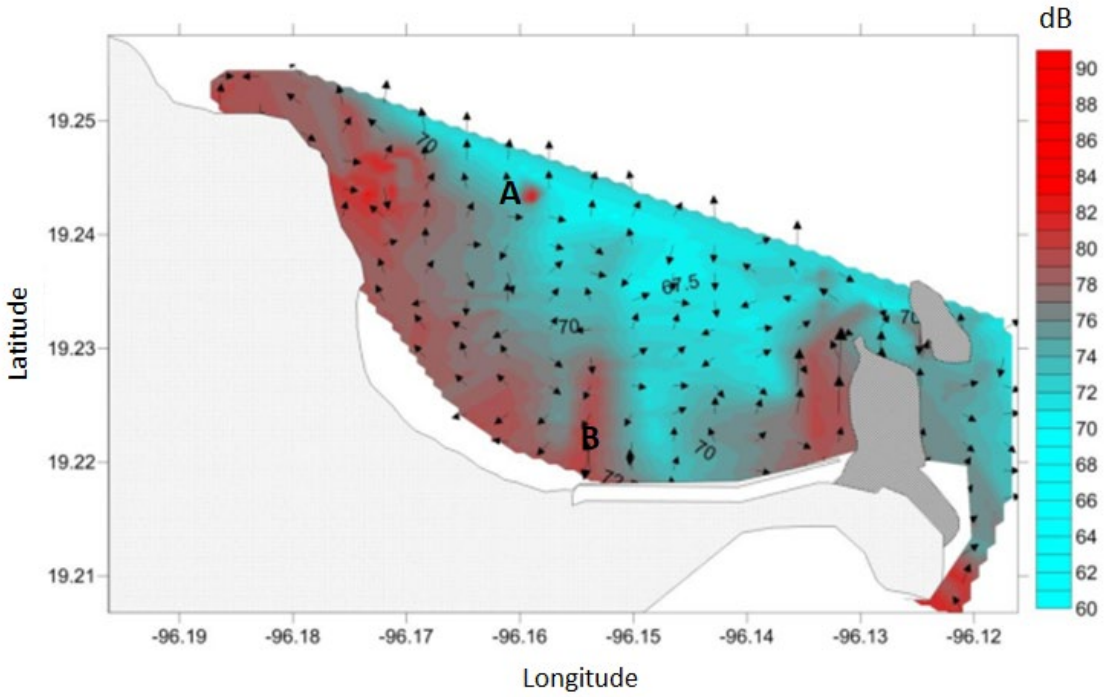

Figure 2 Sediment transport map from 07 january 2016. Red color indicates values equal or higher than 80 dB which represents the 80th percentile of sediments concentration in the water column after24 months monitoring.

The same monitoring provided enough information to characterize natural and anthropogenic variation in sediment dynamics unrelated to port construction. For example, a sediment plume caused by a water treatment effluent discharged in Vergara's Bay persist 24 hours before particles settle (Figure 2, letter B).

Based on information from sediments transport monitoring, a sophisticated preventive and management system for dredging was built. The system relies on real-time maps generated every 30 minutes by four fixed ADCPs. Real-time maps will be available to decision makers and public. An alert system was also created to send text messages and e-mails to decision makers so that they can take preventive actions such as dredging production declines or pauses. The latest version of the monitoring system was elaborated with the participation of the

external supervisors of the University of Veracruz, the authorities of the protected natural area (VRS) and researchers with expertise in sediment dynamics.

5. Conclusions.

- Major infrastructure projects need to incorporate follow-up monitoring to correctly assess environmental impacts.
- An adaptive management scheme is also fundamental to change in accordance with project environmental performance.
- To promote different stakeholders participation in environmental assessment of a project is an important component in follow-up and post-audit
- We consider the Veracruz port expansion project as a good example of how environmental management can rely on monitoring to ensure the best practice in post permit environmental impact assessment procedures.

6. References.

Arts, J., Caldwell, P., & Morrison-Saunders, A. (2001). Environmental impact assessment follow-up: good practice and future directions — findings from a workshop at the IAIA 2000 conference. Impact Assessment and Project Appraisal, 19(3), 175–185. https://doi.org/10.3152/147154601781767014

Glasson, J., Therivel, R., & Chadwick, A. (2005). Introduction to Environmental Impact Assessment. Assessment (Vol. 2nd). https://doi.org/10.1016/0169-2046(95)90007-1

Marshall, R. (2005). Impact Assessment and Project Appraisal Environmental impact assessment follow-up and its benefits for industry. Impact Assessment and Project Appraisal, 23(3), 191–196. https://doi.org/10.3152/147154605781765571

Morrison-Saunders, A., Marshall, R., Arts, J. (2007). EIA follow-up: international best practice principles. Special Publication Series No. 6. Fargo, USA: International Association for Impact Assessment.

Morrison-saunders, A., Arts, J., & Baker, J. (2001). EIA follow-up. Impact Assessment and Project Appraisal, 19(4), 289–296.