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Nuclear heritage of the south of Spain. Diagnosis and proposals

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In Southern Spain there is a firm relationship with all parts of the nuclear power process. Uranium mines and purifying plants, a nuclear waste depot, a non-started nuclear plant and a place that suffered an aerial-nuclear incident integrate the set named "Nuclear Heritage in Southern Spain". Andújar (the Virgen de la Cabeza mines and the former Uranium Purifying Plant "General Eduardo Hernández Vidal"), Cardeña (the Venta del Cerezo mines), El Cabril (the former uranium mines, and the nuclear waste depot by ENRESA), Palomares-Sierra Almagrera lands (that suffered the "*Spanish broken arrow*" in January 17th 1966), Valdecaballeros (the non-birth nuclear power plant at the Extremaduran Siberia) and La Haba (former uranium mines and purifying plant) integrate this set. A set lacking a geographical synthesis study that opens door to further research that can be extrapolated to other regions of Spain.

OBJECTIVES

1. Delimit the infrastructures that make up the Nuclear Heritage in Southern Spain.
2. Carry out a diagnosis of the state of the same, without forgetting the historical route that explains its evolution and current state.
3. Prepare action proposals to value this nuclear heritage, which minimizes the generally negative perception that accompanies these places in relation to the danger associated with uranium.

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METHODOLOGY

The work aims to create a database on the elements of the Nuclear Heritage in Southern Spain, their trajectory, strengths and weaknesses. And from this analysis, make a series of proposals that allow a sustainable development of projects that improve the prospect of these places.

RESULTS

There have been analyzed six places: Andújar (FUA and former uranium mines), Cardeña (former uranium mines), El Cabril (former uranium mines and nuclear waste depot), Palomares (site of a "*broken arrow*" incident), La Haba (former uranium mines and plant) and Valdecaballeros (non-started nuclear power plant). Mostly of them, with the unique exception of Palomares (closely to the Eastern Almerian Mediterranean coast, more known as *Levante Almeriense*), placed in the inner Spain. And with the exception of Andújar –an "agro-city"-, the other places are inside the set named "Emptied Spain".

Andújar has a dual nuclear heritage: the former mines in the north and northeast surrroundings of the Sanctuary of Our Lady of "La Cabeza" and the former uranium refining plant –FUA– "General Hernández Vidal". First, at the mountains about 45-50 km. north and northeast from the municipal capital, and last-the FUA– closely to the urban area from the municipal capital. In itself, Andújar is a region with at least four different landscapes. The mining and quarrying tradition has been millenary at the mountains of Sierra Morena and the north riverside of the Guadalquivir river.

The uranium mines operated from 1955 to 1970. On the other hand, the FUA "General Hernández Vidal" after two years of building, operated from November 1959 to July 15th 1981, after which it underwent a waiting period and a "test bed", before being dismantled and sealed between 1991-94. Its location was logistically unbeatable, but radiologically, worse impossible.

The human drama experienced by the former FUA workers, exposed to extremely high doses of radiation without the proper security measures, far exceeds any analysis. They were not well treated by the hierarchies of nuclear in Spain. In addition, the sealing work of the FUA and the old uranium mines accelerated after the declaration of the Sierra of Andújar as a Natural Park. There are very few publications even technical, on this space. But it is the paradigm of "*what should not to be done*" when setting up a uranium concentrates factory.

The Cardeña´s uranium mines case is very similar-in part– to the previous. The Cardeña and Andújar mountain ranges are separated by the embedded Yeguas river and are geologically and physiographically the same. This uranium mines –that surrounded the small township of Venta del Cerezo– were producing minerals between 1953 to 1970. And later were abandoned until their restoration and sealing in 1998. They were the first uranium mines well studied, and at their restoration, were the most influenced by the UMTRA plans.

The declaration of a Natural Park of Cardeña and Montoro mountains spurred the sealing and restoration works. But it has not yet taken place, and not for lack of initiatives, the take-off of this town, not lacking in environmental attractions. There is very little written about Cardeña, and it would be worth a greater diffusion of its values.

El Cabril is, with no doubts, the biggest element of the set named "Nuclear Heritage in Southern Spain". It is located in the northwest of the province of Córdoba and has been involver for more than a century, first with uranium mining, and in the last six decades with the storage and management of radioactive waste. It is a unique and exemplary facility in this industrial activity of environmental management, as welle as the site of numerous scientific experiments, both related to its activity and to other branches.

El Cabril is located on the eastern slope of the Sierra Albarrrana, a Precambrian and Caledonian base, with extremely poor soils and subsoils with rare minerals. No one lives for more than 15 kilometers around. And all the next towns are losing population since many years ago. Mining activities started in 1918, were stopped by the Spanish Civil War between 1936-1939, and after the war were re-started by private enterprises like BRESA, EPALE, and later, by the public JEN and the private AISLAMIC. Uranium mines were exploited

until 1961, and mica mines were exploited until the end of 1975. From 1961 to 1985 the radioactive waste warehouse was operated by the Spanish JEN (Joint of Nuclear Energy). Since 1986 is operated by ENRESA (National Radioactive Waste Enterprise, S.A.), constituting its main facility, unique in its function in Spain, and the main R+d+i in the Nortwestern province of Córdoba. It has three modules of concrete cells for low and medium level (radioactive) waste another four cells for very low level waste. And its investigative and innovative activity is incessant.

However, despite ENRESA´s effort to publicize its work, something is wrong with the communication policy. Being the best Nuclear Heritage facility in Southern Spain, it has an environmental and leisure potential to be developed.

Palomares is a town situated at the Southeast part of the municipal area of Cuevas de Almanzora, in Eastern province of Almería. Since January 17th 1966, it has part of the Nuclear Heritage in Southern Spain after the air crash of to USAF airplanes (one B-52 and a KC 135 "Stratotanker"), when four B24 H bombs were landed off from the B-52. Two of them burnt, but the other two were rescued –one, 80 days later, from the sea–. The plutonium, instead the decontamination works by the USAF troops during the next year, radioactivity has conditioned the life of this agricultural town and its surrounding places. Specially the former mining zone of Sierra Almagrera, when in 2009 was discovered a zone when the "radioactive spray" detached from the two bombs that burnt, fell.

To this day, the plots affected by radioactivity have been fenced off, expropriated and subjected to surveillance by JEN/ENRESA/CIEMAT. And in the same way, the locals who have presented traces of plutonium in their blood and radioactivity, even though some of them are unusually healthy. Palomares, due to its proximity to the coas –with a notable sustainable tourism– and its powerful intensive agriculture under plastic, is perhaps the exception within the whole.

Valdecaballeros is a small town situated at the Northwestern province of Badajoz, at the region named "the Extremaduran Siberia". Between 1975 and 2001 this town and its surroundings, lived around a project of nuclear power plant that was stopped at first in 1991, and later, cancelled and dismantled in 2001. The project would have been a development chance to that extremely poor and underpopulated region. The "*jabalines*" (Valdecaballeros´ inhabitants) say that "the future of this town was killed without the nuclear power plant".

At the same province of Badajoz, between the regions of Las Vegas Altas and La Serena, there is a small town named La Haba. It´s the opposite case to Valdecaballeros. There was uranium mining between 1953 and 1991, and especially dangerous, an open heaven uranium mine-La Marilozana– that extender radioactivity to the town. And between 1975 and 1993, an "experimental" uranium refining plant, that produced "yellow cake" to nuclear power plants. There was radioactive containers until 1993, and many people at town has died for have been exposed to high doses of radioactivity. It´s usual to listen, at this town, that "uranium has killed it".

CONCLUSIONS

- The study of the double case of Andújar –minas de la Sierra and FUA in its outskirts–, shows evident results of the aforementioned (stigmatization of a territory) from the study of the mines and their trajectory, and the analysis of the taboo subject that they represent the tragedy of the FUA with its consequences of this day. There are clear analogies between the Cardeña-Venta del Cerezo mines and those in the north and north-west surroundings of the Sanctuary of Nuestra Señora de la Cabeza in the Sierra de Andújar.
- The evolution experienced by El Cabril has been outstanding in the last decades. This town has gone from being a place of uranium, mica and beryl mines to the headquarters of the Centralized Storage of Waste with very low, low and medium radioactivity in Spain. Due to its importance and significance after some years relegated to the background by the truncated ATCE project (2013-2020), El Cabril is

the main asset of ENRESA/CIEMAT, and it still has new possibilities, with the development of sports activities and environmental.

- In Palomares, the work carried out through the "Indalo Project" has been analyzed highlighting the positive initiatives that have allowed to improve the perception of this town as a prominent area of avant-garde agricultural development and residential tourism, since the plane crash occurred of nuclear effects on January 17th, 1966.
- Very different is the case of the province of Badajoz, which has experienced two diametrically opposed realities. On the one hand, in Valdecaballeros great hope was enlightened to leave behind its centuries-old scarce development with the unfinished nuclear power plant project, which has given rise to a rather uncertain future. On the other hand, the case of La Haba, where the "uranium fever" extracted from its mines and transformed into its "experimental" ENUSA factory followed the cessation of activity in 1991 and the subsequent tragedy of deaths caused by contact with different radioactive elements.