Constructing High Energy Accelerators Under DOE's "New Culture" for Environment and Safety: An Example, the Fermilab 150 GeV Main Injector Proton Synchrotron

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Abstract

Fermilab has initiated construction of a new Main Injector (150 GeV proton synchrotron) to take the place of the current Main Ring accelerator. "New Culture" environmental and safety questions have been addressed. The paper will detail the necessary steps that were accomplished in order to obtain the permits which controlled the start of construction. Obviously these depend on site-specific circumstances, however, some steps are universally applicable. In the example, floodplains and wetlands were affected and therefore the National Environmental Protection Act (NEPA) compliance was a significant issue. The important feature was to reduce the relevant regulations to a concise set of easily understandable requirements and to perform the work required in order to proceed with the accelerator construction in a timely fashion. The effort required and the associated time line will be presented so that other new accelerator proposals can benefit from the experience gained from this example.

I. INTRODUCTION

The paper[1] "Designing High Energy Accelerators Under DOE's "New Culture" for Environment and Safety: An Example, the Fermilab 150 GeV Main Injector Proton Synchrotron," given at the 1991 conference described the NEPA requirements that were being more stringently adhered to since February 1990 when Admiral Watkins (Ret.) the new Secretary of Energy placed into effect his "New Culture."

In his February notice, Watkins reiterated how, in forming his initiatives, "I found that many of the Department's activities under NEPA had been carried out in a decentralized non-uniform and self-defeating manner. I also state my intention to become personally involved in NEPA decision making and to ensure that NEPA actions are more closely coordinated with the governors of the states which host DOE facilities..."

"Indeed," Watkins continued, "mission goals are best served by early and adequate NEPA planning, which avoids the delays that often follow 11th-hour consideration of NEPA requirements, the resulting failure to comply fully with those requirements and ultimately, the necessity to cure NEPA-related deficiencies before an important project may proceed. If the Department is to err in its judgment as to the extent to NEPA review required of new projects, it should err on the side of full disclosure and complete assessment of environmental impact."

The NEPA legislation besides setting forth a national policy for the environment, established the Council on Environmental Quality (CEQ). The CEQ issued Regulations for Implementing the Procedural Provisions of NEPA. These rules are found in the Code of Federal Regulations (40 CFR Parts 1500-1508). This is where the methodology of Environmental Impact Statements (EIS) with the final action of a Record of Decision (ROD) was established. Also, the simpler process of an Environmental Assessment followed by a Finding of No Significant Impact (FONSI) or a determination that an EIS is required was outlined.

As Watkins' emphasized, it is important to start the NEPA process as early as possible; however, it is obvious that the design has to have progressed sufficiently that enough information is available that environmental studies are feasible. In the case of the Fermilab Main Injector (FMI), this point was reached in the fall of 1989.

The FMI will be a 150 GeV accelerator with a circumference of about one-half that of the existing Main Ring. The FMI would be situated tangent to the Tevatron at the F0 straight section[2] in the southwest corner of the Fermilab site. The FMI is being constructed using newly designed (iron and copper) dipole magnets.

The FMI, whose location is shown in Figure 1, must serve a number of purposes. It must function as a bi-directional injector into the Tevatron. This means it must be near and approximately tangent to the Tevatron. Secondly, it must receive 8 GeV protons from the Booster and 8 GeV antiprotons from the Antiproton Source. It must also provide 120 GeV protons to the antiproton target. Finally, the FMI must provide a 120 GeV beam to the present Fermilab fixed target facility hardware.

The principal housing of the FMI utilizes below grade enclosures. The FMI ring enclosure is an oval-shaped, below grade structure, approximately 10,900' long, with a 10' wide by 8' high cross section. The floor of the enclosure will be level and at an elevation of 713'6" above sea level, 18' to 33' below existing grade. Earth shielding berms over the FMI enclosure provide the required 21' of earth equivalent shielding.

Details concerning the "Status of the Fermilab Main Injector Project," V.D. Bogert et al, are contained in paper Gc22[3] of this conference.

II. ENVIRONMENTALLY SIGNIFICANT ACTIONS

Beginning in April 1990, $200,000 of Illinois Challenge Grant funds became available to conduct environmental studies and preliminary design. The first activity was to prepare the application for the joint permit for

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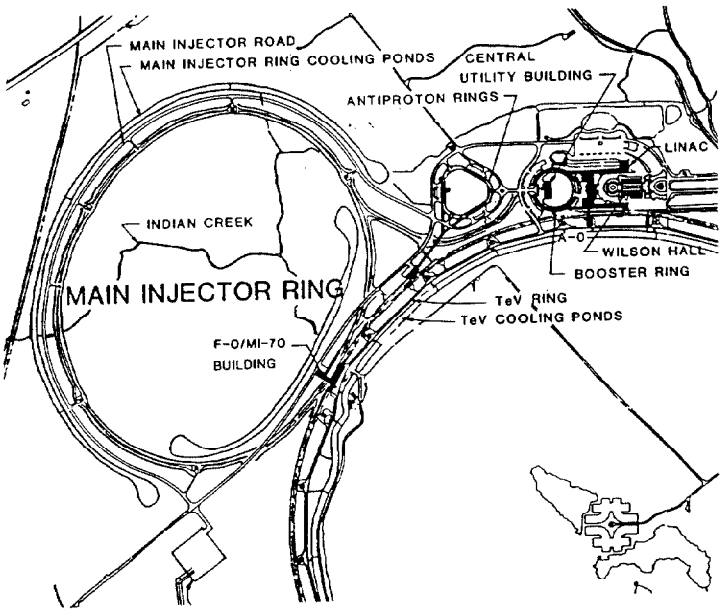

Figure 1. Fermilab Main Injector location. Indian Creek crosses the ring at several points. Approximately 100 acres of wetland is adjacent to the creek. The area of wetland that has been permanently filled is six acres.

filling of the wetlands and the modification of the floodplain of Indian Creek. The application was submitted in September 1990.

The U.S. Army Corps of Engineers (COE) issued the permit for filling the wetlands on June 26, 1991. Special conditions were included which required their approval of construction drawings prior to initiating construction.

In parallel, an Environmental Assessment (EA) was prepared which required several drafts. The submission to the environmental part of DOE occurred in April 1991. After publication for public comment the EA was found acceptable and a FONSI was issued on July 6, 1991. Of particular importance to the FMI Project was that this action included the finding that no EIS was required. If this had not been the case, the EIS process would have added an estimated 1 1/2 years to the project's duration. Illinois provided an additional grant of $2,000,000 in the spring of 1991 of which $500,000 was specified for environmental efforts.

Using the above plan, the funds expended for the environmental effort for the FMI is estimated to be $1,400,000 since Fermilab has matched the funds of the State of Illinois as required by the terms of the Grant.

Because of the availability of Illinois funds it was possible to hire the architect/engineering firm of Fluor Daniel who prepared construction drawings and specifications for the wetland/floodplain construction. These were submitted to the COE who approved the package on February 5, 1992, and on July 15, 1992 the COE was notified in accordance with another special condition that construction would start on July 22, 1992.

The Illinois Department of Transportation/Division of Water Resources also had to approve the work, which included the creation of 22 acre-feet of floodwater storage, in the floodplain of Indian Creek. Their permit, based on the Fluor Daniel drawings and specifications, was issued on April 3, 1992 so that this was in hand when the DOE released the funds for the wetland/floodplain construction work.

Due to favorable weather conditions in the fall of 1992, all the wetland/floodplain work was completed without incident with the exception of planting of the newly created 8 acres of wetland area. Spring planting is now underway and a five year monitoring program required by the COE is being put in place.

The great blue heron rookery which had been located in the approximate center of the new ring, was abandoned prior to the start of the FMI construction. This was due to the presence of a red-tailed hawk which decided to nest in the same tree and drove off the herons as they arrived. The herons took advantage of an alternate site in the center of the existing accelerator ring where the trees had reached a height suitable for heron nests and have not returned to the old site in subsequent seasons.

Another important event occurred on October 1, 1992 when a new provision of the "Clean Water Act" was brought into enforcement. The Illinois Environmental Protection Agency (IEPA) took on the task of enforcing the requirement for permits for stormwater discharges associated with construction activities in the State of Illinois. Since the FMI was under construction at that time a National Pollutant Discharge Elimination System (NPDES) stormwater discharge permit was required. The procedure adopted by IEPA was that they issued a general permit on October 20, 1992. Fermilab on September 24, 1992 based on an earlier draft issued a Notice of Intent (NOI) to qualify under the Illinois general permit.

Requirements include that Fermilab must have on file a Stormwater Pollution Protection Plan which is kept up-to-date by revisions as details of construction activities become firm. In addition, an Environmental, Safety and Health Procedures for Soil Erosion and Sediment Control for Construction Activities was prepared. Of interest is that each contractor signs a Certification that he understands the terms and conditions of the NPDES permit.

Figure 2 shows an air view of the Fermilab site with a white oval indicating the position of the tunnel. The FMI construction is entirely within the Fermilab site and, with the exception of the wetlands referred to in the above, involves previously farmed, almost flat areas.

III. ACKNOWLEDGMENTS

While it is true that I played a major role in the NPDES activity before the stormwater permit was required beginning on October 1, 1992, the work associated with this new requirement was carried out by Rod Walton and Linda Even.

IV. REFERENCES

[1] William B. Fowler, "Designing High Energy Accelerators Under DOE's "New Culture" for Environment and Safety: An Example, the Fermilab Main Injector Proton Synchrotron," *Conference Record of the 1991 IEEE Particle Accelerator Conference*, Vol 2, p. 854.

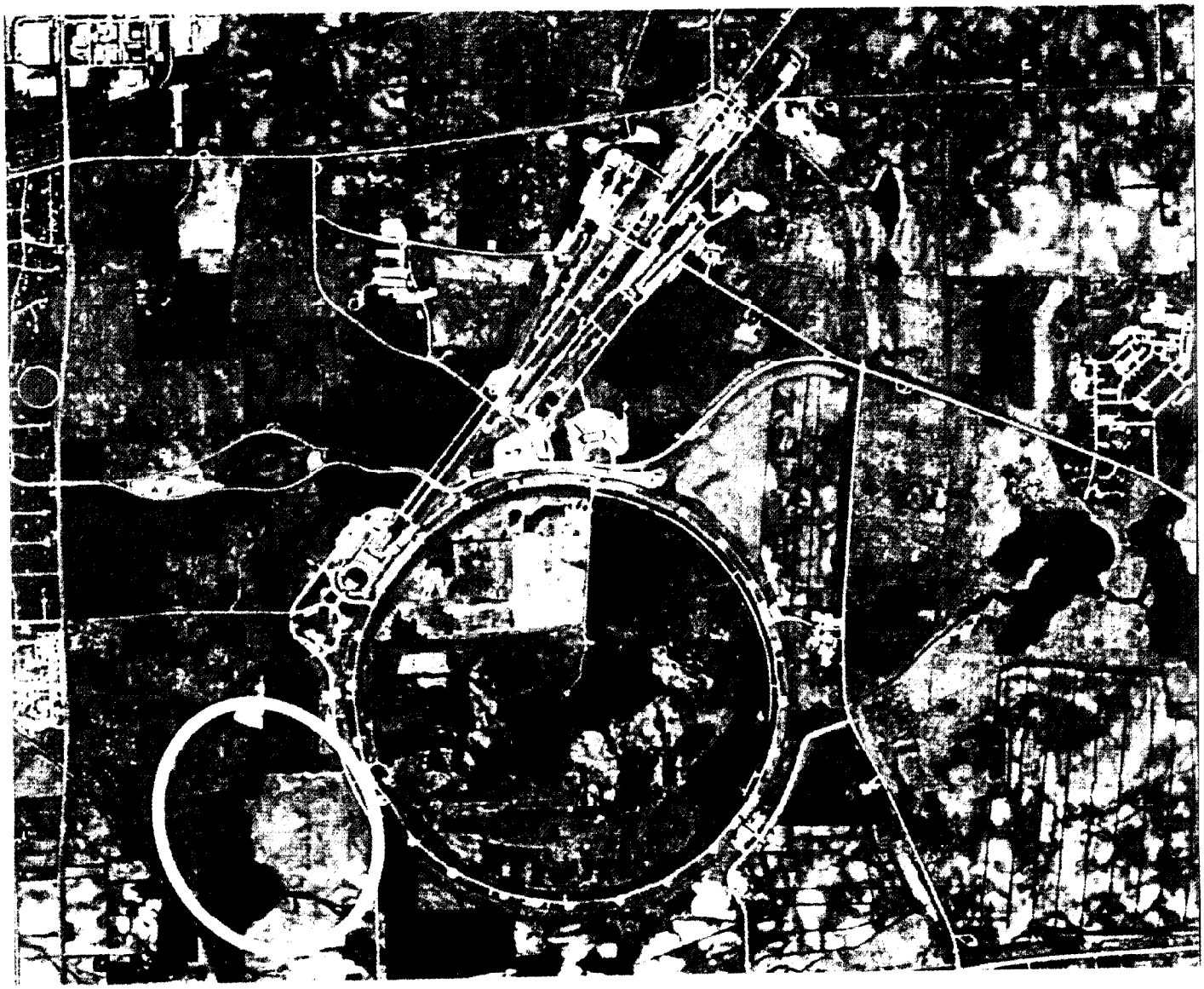

Figure 2. Air view of the Fermilab site with heavy white oval indicating the location of the new accelerator tunnel.

[2] The Main Ring and Tevatron Accelerators are designed with six straight sections, where the beam travels a short distance in a straight line, alternative with six arc sections where it follows the path of a circle with a radius of one kilometer. These 150-m long straight section are labeled A0, B0,.....F0, and are spaced equally around the ring.

[3] D. Bogert et al, "The Status of the Fermilab Main Injector Project", paper Gc22 of this conference.