

Staff Report

Date: December 14, 2020
To: **Devens Enterprise Commission**
Cc: Peter Lowitt, DEC Director;
From: Neil Angus, Environmental Planner
RE: **111 Hospital Road – CFS-2 Level 2 Unified Permit**

Owner/App.: MassDevelopment Finance Agency/ Commonwealth Fusion Systems, LLC.
Location: 111 Hospital Road, Devens, MA
Zoning: Innovation & Technology Business District, Watershed & Aquifer Water Resources Protection Overlay District

Premises and Proposed Project: VHB Engineering, on behalf of Commonwealth Fusion Systems (CFS), has submitted a Level 2 Unified Permit for the development of a +/-147,000 sf fusion energy research and development facility (CFS-2) and associated site improvements:



This application also seeks conceptual approval for the overall campus master plan (general size, location and layout) for future development phases. CFS- 2 will be home to a compact fusion device that will prove fusion can work as a clean, reliable power source. As the proposed project is a research and development facility (not a power plant), it will also include the equipment and instruments needed to operate, monitor and maintain the

device. A concurrent application has been made for CFS-1 - the magnet facility, so that both buildings and associated site improvements can be reviewed independently while viewed together in context to one another and to the campus master plan as a whole.

Fusion is the natural process that powers the sun and the stars. It is the reaction where two atoms of hydrogen combine or fuse, to form an atom of helium. In this process, some of the hydrogen is converted into energy. To make fusion happen, the atoms of hydrogen must be heated to very high temperatures (100 million degrees) to form plasma and have sufficient energy be held together long enough for the fusion reaction to occur.

Scientists have been studying fusion for decades and have been able to safely create fusion in the laboratory. According to the Applicant, the most common and successful approach to create fusion on earth is using a device called a tokamak. A tokamak is essentially a fully contained magnetic bottle that simulates the vacuum of space and uses magnets to confine a super-heated plasma in which fusion occurs. This confinement is essential - if any air gets into the system it will shut off in a fraction of a second and go back to room temperature. This makes fusion difficult to achieve on earth, but also inherently safe according to the Applicant. For example, if power to the tokamak went out, the machine would turn off and the fusion process would simply stop. If there were any breach in the system, air would get inside and the process would stop.

The Applicant has indicated that there have been more than 150 tokamaks built all over the world that use this approach to achieve fusion, including one at MIT in Cambridge. However, there has never been a tokamak or any fusion device that has shown fusion can work as a net-positive energy source because currently they all consume more energy than they produce. CFS is working collaboratively with MIT to propose building a tokamak research and development facility at Devens called SPARC (CFS-2), similar to the one in Cambridge, that will produce net positive energy from fusion for the first time in history. The key to making this happen is the new advanced magnets that would be constructed in a separate building (CFS-1) on-site. These magnets would create a strong magnetic field inside the tokamak to confine the fusion process. In the past, this type of magnetic field would require a very complex, expensive, and enormous device that is slow to build. But these new advanced magnets allow CFS to build a compact device faster and less costly that can achieve net positive energy from fusion. This project is being developed to enable the commercialization of fusion energy and help combat climate change - since fusion doesn't emit carbon dioxide or other greenhouse gases into the atmosphere. Fusion's main by-product is helium: an inert, non-toxic gas. The process does involve some hazardous materials used in the process that will need to be safely managed (see public safety section below).

Key Project issues:

The complete application has been circulated to MassDevelopment and the full DEC Peer Review team: Nitsch Engineering (site plan, stormwater, and traffic), IBI Group (landscaping), and Tech Environmental (light, noise, electromagnetic interference). The following is a summary of those reviews and the key issues raised:

Phasing: The first phase of the CFS-2 development includes the SPARC facility which will be home to the tokamak research and development facility. As CFS plans to make this site their world headquarters, future expansion is anticipated. The Applicant has included an overall Master Plan for the campus showing potential future growth and investment at the site. This growth would include an expansion to the CFS-2 SPARC facility, as well as additional buildings (CFS-3 – industrial facility similar to CFS-1; and CFS-4 and 5 - Research and Development Support, office, and warehousing). The master plan also includes a future potential outdoor gathering/meeting space in the woods for connecting employees with nature. This future growth is conceptual at this stage and would require separate Level 2 Unified Permit(s) to ensure compliance with the Devens Bylaws and Development Rules and Regulations. Staff has requested additional detail on breakdown of the proposed buildings and uses to ensure the project will comply with the Floor Area Ratio limits for the ITB District. The Applicant has also included a site logistics plan for CFS-2 construction - to show where excess material, construction laydown, and contractor parking will be located. This is approximate but it is an important consideration given the size and scope of this project.

Access, Parking and Traffic: The facility will be accessed via the two new driveways that are being constructed as part of the CFS-1 project. As CFS-2 is proposed to be on a separate parcel, the Applicant will need to ensure that the proper easements are in place to access the site. The proposed parcel configuration will need to comply with DEC regulations (size, setbacks, frontage, FAR, etc...). The CFS-2 project will not have any full-time employee work

stations. Employees will all be located in the CFS-1 building. The Applicant has proposed 24 parking spaces for visitors, vendors and service providers that may need to access the CFS-2 facility. To estimate potential new vehicular traffic at CFS Building 2, it was assumed that 50% of the proposed 24 parking spaces would turnover once during the weekday morning and weekday evening peak hours, resulting in 80 weekday daily trips in and 80 out. This is in addition to the 339 trip in and 339 trips out expected from the CFS-1 project (838 trips total). The Applicant states that the 80 trips in and 80 trips out is a conservative estimate of new vehicular traffic at CFS Building 2. The Traffic study prepared for both the CFS-1 and CFS-2 projects concluded that the proposed entrances are located with adequate sight distance for vehicles to safely turn in and out of the site. While the majority of traffic will be associated with the CFS-1 portion of the project, however, as this is a fairly unique project, the Applicant should provide additional information on expected materials delivery (truck trips) to and from the site, as well as visitors as this may impact traffic to and from the site. The DEC's Peer Review Traffic Engineers requested additional details on any adjustments to 2020 traffic data due to the COVID-19 pandemic, and requested clarification on the transportation demand management strategies being implemented (carpooling, vanpooling, shuttle service, bike access, etc.) to ensure the site plans support these initiatives.

Public Safety: The Applicant has provided additional supporting information that explains the proposed project (refer to attached Memo from Commonwealth Fusion Systems dated November 20, 2020). The fusion fuels used in the device are isotopes of hydrogen – deuterium and tritium. The facility will also require low amounts of process gasses such as hydrogen, helium, nitrogen, diborane, and neon. Deuterium, is extracted from water. Tritium, is a radioactive form of hydrogen with a short half-life that is produced in the atmosphere. It is found in small amounts in groundwater throughout the world. Tritium is also found in everyday objects that are self-luminous such as exits signs, watch dials and navigational compasses. Tritium makes these devices glow without the need for electric power. CFS plans to have a small inventory of tritium on site - 10 grams (approximately the size of two quarters). Their device will only use approximately half a gram at any time to run. As it is a radioactive material, Tritium requires special handling on site and a license from the Massachusetts Radiation Control Program (MRCP). This entity will also regulate the safe operations of the fusion device and any decommissioning. Tritium on site will be stored in accordance with MRCP requirements and using proven safety methods and best practices from the various sites around the world that include national laboratories, medical research facilities and hospitals. CFS will have systems in place to monitor the tritium to ensure it stays contained. They have pledged to have storage, safety and containment strategies in place that are “significantly more robust than what’s required by regulation, with built-in redundancies and layers of protection”. Staff has been in contact with the MRCP and will coordinate with them on any regulatory issues. Gas produced from the fusion process will be small amounts of helium. This is less than a few grams over the life of the system.

A Hazardous Materials Spill Response Plan and Spill Pollution Prevention Control and Countermeasures Plan will be required as a condition of approval and will need to specify the materials, types, quantities, location and method of storage/containment, handling and disposal as per 974 CMR 4.09.

The Applicant has indicated that the fusion device will produce neutrons and as a result will be fully shielded with concrete to protect from radiation. Combined this is a factor of 10 below the yearly limit allowed by the MRCP and not harmful to the public. This increase at the site boundary would be extremely small and nearly indistinguishable from background radiation. It is important to note that because this is a research facility, the fusion process will not be continuous (this is not a power generation facility).

The project will tie into the Devens utility network for electricity, gas, water and sewer. Electricity for the site will be ramped up using a motor generator. Any power generated from the fusion process would be returned back to the motor generator. There are no anticipated unique discharges to the wastewater system that would require any pre-treatment on-site. Cooling towers will produce typical emissions and the Applicant is exploring options for on-site reuse of cooling tower emissions water.

Industrial Performance Standards: To help avoid potential nuisance conditions, the Applicant has designed the facility with due consideration for the surrounding land uses. The closest sensitive receptors include the new housing on Grant Road, New England Studios, Aspire Adult Daycare facility, and the US Fish and Wildlife Service Oxbow National Wildlife Refuge Visitors Center.

Lighting: DEC Regulation require 0.5 footcandles for walkways and driveways. A review of the photometric plan shows a few areas where lighting locations may be able to be adjusted to reduce light levels in some parking areas. All site lighting is proposed to be fully shielded and downward directed to prevent off-site glare. The Lighting table on the photometric plan specifies all lights to be 3000K, however the lighting details need to specify this as well (they have several different model types for each detail). The Applicant should also indicate if any lighting is required to remain on overnight and if so, how it can be minimized. Any lighting controls (timers, photocells, etc.) should also be indicated. Light fixture and pole colors also need to be dark earth-tone colors (some are specified as being white).

Noise: The building is located in the central portion of the site away from the residential receptors on Grant Road and the majority of utilities are proposed to be behind the building so that they are shielded from any direct exposure to the residential areas. A complete noise study of both CFS-1 and CFS-2 is underway by the Applicant. They are collecting background sound information and will produce a model to determine what, if any, noise mitigation may be required to be integrated into the project to prevent any nuisance conditions and comply with 974 CMR 4.05. A complete study is expected before the next hearing date.

Electromagnetic Interference (EMI): The primary contributor to EMI from the Project site is the magnets associated with the tokamak. The Applicant has reviewed the expected magnetic field strength at the nearest property boundary and the expected magnetic field intensity is very low (0.1G or 10uT). This is below natural background levels.

Air Emissions: Cooling towers and emergency generators, boilers and humidifiers are the main pieces of equipment that will contribute to the overall site emissions. Emissions are expected to consist of mainly water vapor but the Applicant will need to clarify the height of the proposed stack and what the chemical composition of the emissions is expected to be from the SPARC activities (and any potential for odors). The Applicant has indicated that during operations of the fusion device, very small amounts of tritium will be released out of the exhaust stack. The Applicant has indicated that no air permits are required from MA DEP.

Devens Engineering and Utilities: Devens Engineering and Utilities have a number of comments regarding proposed parcel boundaries, easements, existing and proposed utilities. Due to the existing previous development (roads and former army housing), there are a number of existing utilities that will need to be abandoned, relocated, reconnected, removed, and/or replaced. As MassDevelopment is both the property owner and the municipal utility for this project, it is important that these issues be addressed.

Soil Management: Like CFS-1, this property is subject to certain Land Use Control Implementation Program (LUCIP) requirements from the Army; permanent use restrictions within a former 37-MM ordinance firing area (UXO); and a specific soil management plan for the Oak and Maple Housing Areas. Due to all of these controls, a Soil Management Plan will be required to be prepared and submitted by a Licensed Site Professional that summarizes soil management methods including appropriate environmental protections and worker safety/education associated with the Oak/Maple Activity and Use Limitations (AUL). A Health and Safety Plan will also be required to be prepared and submitted by a Certified Industrial Hygienist or other qualified individual summarizing appropriate personal protection, engineering controls, and environmental monitoring to prevent worker exposures to contaminated soil associated with the Oak/Maple AUL. MassDevelopment's Environmental Engineer has also requested that the plans and supporting materials be updated to include and reference all appropriate land use controls that this property is subject to.

Stormwater Management: The DEC Peer Review Engineers reviewed the site plan and stormwater management design in accordance with the DEC Regulations. The Applicant has proposed some low-impact development techniques to manage some of the runoff from impervious areas however there appears to be more opportunities to incorporate more Low-Impact Development techniques (LID) throughout the site to comply with 974 CME 4.08 and minimize pavement/impervious areas and reduce stormwater and urban heat island impacts. Internal road widths and utility areas in the rear of the facility and north of the CFS-2 building could be minimized, while still providing ample space for vehicle turning movements. While the applicant has included subsurface infiltration structures to meet the DEC's Greenfield requirement, there appear to be other opportunities to utilize stormwater on-site for alternative uses such as irrigation. Underground cisterns could be used to store roof runoff for irrigation of the large lawn/recreation areas in front of the building and reduce the need for potable water use. A Construction General Permit from the EPA and a Stormwater Pollution Prevention Plan still need to be provided to the DEC prior to the commencement of any activity on-site.

Slope Resource Areas: The site contains a number of Slope Resource Areas (SRA's). The Applicant has designed the project to avoid direct impacts to these sensitive areas. No work is proposed within the SRAs or within 15 foot No Disturbance zone. However, construction is proposed within the outer 35 foot buffer near the northwest corner of CFS Building 2 service yard where grading and a retaining wall is required for service and fire truck access around the building. Most of the construction activity proposed in the buffer is within the previously disturbed footprint of former Plum Street, and there are no specimen trees impacted. Additionally, there are no proposed surface water discharges that could cause erosion and destabilization of the steep slopes. However, a significant volume of fill from grading will introduce new loading (additional weight) near the top of the slope. Haley & Aldrich, the project team's geotechnical engineer, conducted a slope stability analysis to determine if any soils stabilization mitigation is required. The study concluded that "construction of the proposed retaining walls and soil slopes within the 50-ft buffer zone (as currently designed) will not adversely affect the factor of safety of the soil slopes within the existing Slope Resource Area." The DEC's Peer Review Engineers are reviewing this report for any issues.

Landscaping: The DEC's peer review Landscape Architects have reviewed the plans for compliance with 974 CMR 3.04(8). There are a number of modifications required to the erosion and sediment control plans which should also show the limits of clearing, construction laydown and temporary sedimentation basin locations. If there are opportunities for additional reduction in impervious as discussed in the stormwater review, the Applicant will need to revise the landscape plans. Additional comments regarding plant species selection, stabilization of all disturbed areas, soil compaction and landscape management will also need to be addressed.

Waiver Requests:

The Applicant has requested the following waiver:

974 CMR 3.04(3)(a)1.h.: There shall be bicycle storage facilities provided on site for all developments.

There are no full time work stations in CFS-2. Employees will be stationed in the CFS – 1 and bicycle storage is provided there.

Application and Process: VHB, Inc., on behalf of Commonwealth Fusion Systems, LLC., submitted the Unified Permit Application on November 12, 2020 and the Determination of Completeness was issued on November 20, 2020. Copies of the application were received by the surrounding Towns on November 24, 2020. Legal notices were placed in Nashoba Publications on November 27, 2020 and December 4, 2020. All abutting property owners were duly notified by certified mail. The 30-day Town comment period expires on December 25, 2020. To date, no comments have been received. The 75 day review period for the DEC to act on this application ends on February 3, 2021.

Recommended Action: The 30-day town comment has not expired so the commission will need to continue the public hearing once the Commission and public have had an opportunity to ask any questions and comments, The DEC should continue the hearing to the January 7, 2021 meeting at 7:30AM to allow the sound study and any additional information to be submitted and reviewed.

Attachments: [CFS Safety Questions Memo \(November 20, 2020\)](#)
[Application Package](#)
[Site Plan](#)
[Peer Review Comments](#)